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THE SURGICAL CLINICS
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Volume 3 Number 1

CLINIC OF DR. JOHN B. DEAVER

LANKENAU HOSPITAL

IRREDUCIBLE RIGHT INGUINAL HERNIA; APPENDIX AND CECUM IN SAC

FOR this afternoon's clinic I think I can promise a number of interesting and, I hope, instructive cases. The first patient is a male, sixty-one years of age, with an irreducible right inguinal hernia of one year's duration. He was sent to the clinic by his family physician, Dr. Wilden, whom he had consulted because he thought the hernia was a little larger than usual. The doctor tried to reduce the hernia by gentle taxis, but without success, and so advised immediate operation. Proceeding, I expose the scrotum and the right inguinal region, and at once you will note a very large scrotum and much fulness over the lower portion of the right inguinal region. Percussion over the swelling gives a mixed note, fair resonance above and flatness below; auscultation over the upper part of the swelling reveals the presence of peristalsis, but this is absent below. This, then, is not a strangulated hernia, first, because there are none of the subjective symptoms—pain, vomiting, inability to pass gas—and, furthermore, absence of the expression of a patient who is very ill. What is the difference between an irreducible and a strangulated hernia? An irreducible hernia is one that does not go back of itself and cannot be put back by taxis, in this respect resembling a strangulated hernia, but differing from the latter in that the circulation, vascular and fecal, is present, both of which are absent in a strangulated hernia. The arrest of the blood-vessel circulation is the danger-point in a strangulated hernia, and therefore demands very prompt operation. There is another type of hernia that frequently causes some indecision as to the best thing to do, and that is incarcerated hernia. This differs from either of the other types in that the fecal circulation alone is arrested. Practically all forms of irreducible hernia should be subjected to operation, since taxis is more dangerous than incision and reduction. Taxis, in fact, is responsible for the high mortality in operation for strangulated hernia, it not only causes delay in the operation, but bruises and contuses the contents of the hernia, and in many instances causes bleeding into the wall of the bowel and the mesentery; furthermore, it increases the danger of operation, since bowel resection is so often required following it. With these results of taxis in mind we surgeons are often appalled to think that so barbarous and life-destroying a measure is still being taught to medical students. Two other causes of death are purgation and delayed operation, due oftentimes to failure to make a thorough physical examination when the patient is first seen.

The patient being under the anesthetic, we will now proceed with the operation. I carry an incision over the swelling, dividing the skin, the superficial fascia and the aponeurosis of the external oblique muscle, thus exposing the posterior layer of the anterior sheath of the rectus muscle, the arching fibers of the internal oblique muscle, the canal, and a protrusion in the canal, over which the cremaster muscle lies, I will now introduce the end of the handle of the scalpel beneath the free border of the arching fibers of the internal oblique muscle, carrying it far enough upward and outward to lift up the arching fibers of the transversalis muscle; following the knife with the tips of my two index-fingers enables me to separate the peritoneum by breaking through the transversalis fascia and the preperitoneal fat for a sufficient distance from the transversalis muscle, so that when the neck of the sac is tied and divided the stump will lie well up behind these muscles. An easy means of identifying the sac is offered by incising the peritoneum high up and carrying the finger through the opening and downward into the sac. This also simplifies the delivery and the removal of the appendix; for in operating upon right inguinal hernia it is my practice, with few exceptions, to take out the appendix.

When you anticipate removal of the appendix in a hernia operation, I advise you not to do so without proper consent unless you know your patient very well, otherwise you may have a law-suit on your hands for having done an operation without the consent of the patient.

Having opened the peritoneum and introduced my fingers, I am able to carry the finger down through the peritoneal extension into the scrotum and demonstrate the presence of a large sac. I now open the anterior wall of the sac together with the upper portion of the overlying walls of the scrotum, thus exposing the intestine. In grasping the contents of the sac between my fingers and thumb in this manner I find I am unable to withdraw them from the sac. I will therefore carry the index-fingers of my left hand well down into the sac, and as I do so I meet with adhesions between the contents of the sac and the sac wall. Upon separating these adhesions there is liberated a foul-smelling, dark fluid. We have a culture made of this fluid. Before going further with the reduction of the hernia into the wound I will thoroughly pad off the opening in the peritoneum in the upper portion of the canal, hoping thus to avoid contamination by contact of the fluid contained in the lower portion of the sac. I will pause here for a moment to say that in operating for a strangulated hernia, after the sac is opened and before the constriction is divided, the sac should be thoroughly cleaned, so that when, in dividing the constriction, the communication between the sac and the peritoneal cavity is established, there will be the minimum chance of peritoneal contamination. Now then I will continue evacuating the contents and deliver them into the wound. Much to my surprise I find that the contents of the sac consist of the terminal ileum, the cecum, and the appendix; the cecum, as you see, is gangrenous and perforated (Fig. 1). This will entail excision of the terminal ileum, the cecum, and a part of the ascending colon. This having been done, and the ends of the ileum and colon invaginated, I make a lateral ileocolostomy and close the upper portion of the wound. Next I will drain the lower part of the wound, including the scrotal portion, with gauze and one rubber drainage-tube, which will protrude through a counter-opening in the base of the scrotum.

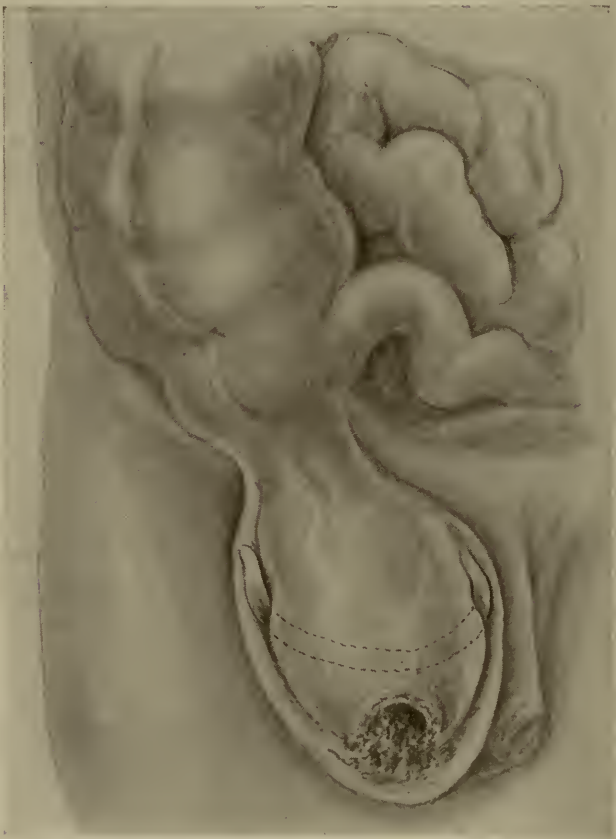

Fig. 1.—Caput coli with vermiform appendix in hernial sac. Note the perforation in the bowel.

The outstanding features in this case are the length of time the hernia has been present and the absence of symptoms; the presence of a bowel perforation which practically became extraperitoneal; the fact that there were normal bowel movements. The latter is explained by the absence of obstruction to the terminal ileum and the upper part of the cecum. How long the inflammation and the perforation have been present is, of course, problematic.

The packing will be renewed in three or four days. This means that the wound will heal by granulation. With this manner of healing a recurrence of the hernia is more apt to take place than when the wound heals by first intention. This is an additional argument for early operation for strangulated hernia. In the ordinary operation for inguinal hernia it is my practice to use linen thread for the deep sutures, although it is not the practice of surgeons generally at the present day. My reason is that the tensile strength of linen is greater than that of either catgut or kangaroo tendon, therefore is less likely to break during an attack of coughing or vomiting which occasionally occurs after operation. For this reason also, in patients who suffer from chronic bronchitis or asthma, I feel safer in using a linen suture, since the breaking of a suture or sutures from coughing during healing means a recurrence of the hernia. For closing the deep portion of the canal I use the interrupted and not the continuous suture.

The objection to linen or silk sutures, on the other hand, is that if infection of the wound occurs the suture or sutures become infected, and unless they ulcerate out or are taken out by the surgeon a sinus or sinuses will form, which means that healing is long delayed.

I want particularly to impress upon you the importance of a thorough knowledge of the anatomy of the region operated upon. This means safety and surety to the patient and easy work for the surgeon.

RECURRENT ACUTE INTESTINAL OBSTRUCTION

The next patient is a young woman twenty years old, a nurse. She was operated upon in August, 1919, in another hospital, for chronic appendicitis. The wound became infected, necessitating free incision and healing by granulation. Following recovery the patient remained well until four months ago, when she commenced to have a slight sticking pain in the lower right abdomen, coming on at any time, but especially at night, causing her to "curl up," as she put it. I was asked to see her on November 27, 1922, when I found her suffering from incomplete intestinal obstruction for which I operated the following day, finding extensive adhesions at the ileocecal junction and the surrounding region. Release of adhesions and closure of the wound were followed by an uninterrupted recovery. The patient remained well until three days ago, when she developed symptoms of recurrence of the obstruction necessitating the present operation.

The patient being relaxed, I will proceed to open the abdomen at the site of the original incision. I am able to show you the presence of adhesions involving the small bowel, the terminal ileum, and the cecum. These adhesions are easily released. Ordinarily what I have done should suffice, as I have straightened the bowel and restored its normal lumen, but in view of the fact that adhesions formed after my first operation for obstruction, I think it safest to make an ileocolostomy between the terminal ileum proximal to where it was adherent and the transverse colon just distant to the hepatic flexure. I have practised this so often that I have no hesitancy in doing it in this patient. The most important point in this type of case is to operate at the earliest possible moment. It is futile and dangerous to hope that enemas, stomach washings, and drugs of any kind will benefit, for they will not. Once the diagnosis is made, operation is the only treatment. Even should there be doubt as to the presence of obstruction, it is better to operate and find nothing calling for mechanical relief, than to operate and find a gangrenous section of bowel which always makes the outcome uncertain.

What is the after-treatment in these cases of resection and anastomosis or anastomsis only, as in this case? It consists chiefly in the relief of the pain by the administration of morphin or heroin, enough of either to keep the patient comfortable. Nausea, belching, hiccup, and regurgitation of dark fluid can be relieved by lavage, practised as often as is necessary. It is our custom in anastomosis cases involving the large bowel not to give enterocylsis for the first twenty-four hours. If there is occasion to administer fluids at once, this can be done by intermittent or continuous hypodermoclysis or intravenous infusion until continuous enteroclysis is started. These patients are usually given an enema at the end of three or four days, but never a cathartic. Where there is more than the normal amount of distention, which is not relieved by an asafetida enema or by asafetida suppositories, I advise hypodermics of eserin and strychnin. These are given in what we call courses of six doses, $\frac{1}{40}$ grain of eserin every hour, with $\frac{1}{60}$ grain of strychnin with the first, third, and sixth doses. Eserin should not be given in mechanical obstruction until after the relief of the obstruction. I do not use pituitrin. I consider it a dangerous drug as compared with eserin, and not as useful as the latter. Pituitrin in obstetric cases has been known to rupture the uterus, and therefore is quite capable of rupturing the distended intestine. Its action is sudden and explosive, while eserin acts slowly. The action of the two drugs may be compared to the powerful action of croton oil as against the mild aperient action of cascara.

Fluid, either in the shape of water or of nourishment, is not given by mouth after serious intraperitoneal operations until there is restoration of peristalsis, as determined by auscultation or by the passing of flatus per rectum, or into the enteroclysis container, as noted by the nurse and sometimes by the patient himself. If the patient gets along well for the first three or four days it usually means that the sailing will be smooth after that, barring, of course, an occasional stitch abscess or wound infection. In my experience wound infection occurs in a certain percentage of the intestinal anastomosis cases no matter how careful the technic, particularly when the anastomosis has been made for an acute obstruction.

MULTILOCULAR PAROVARIAN CYST

I WILL next operate upon a young married woman, thirty-four years of age, who has never had children. The patient has a history of chronic constipation. On one occasion, in the spring of 1922, she was not able to have a movement of the bowels for several days, and was finally relieved after the administration of several enemas. After the obstipation was overcome she discovered a tumor in the right side of the abdomen, which has grown steadily since, causing a continuous dull pain in the right abdomen. For the past two or three years she has had a full, heavy feeling around the heart, aggravated by walking or by excitement, and relieved by belching or by a bowel movement. Slight edema of the ankles has been present for the past year. Until recently menstruation was regular, of the twenty-eight-day type. At present she has two or three periods every month. The patient also gives a history of a fall seven years ago, when she struck the right side of her abdomen.

Physical examination of the abdomen shows a hard, slightly nodular tumor, which descends very little, if at all, on deep inspiration, and extends from the right costal margin down to Poupart's ligament, and from the right anterior superior spine across the abdomen 2 inches below the umbilicus to the junction of the ninth costal cartilage with the external edge of the left rectus muscle. The tumor does not seem to be connected with the liver, as there is an area of tympany between the right costal margin and the supposed upper edge of the tumor. The liver is not palpable even on deep inspiration. In the lower midabdomen the mass is cystic, with dulness, fluctuation, and a fluid impulse. There is tympany in both flanks. By vaginal examination there is a palpable mass to the right of the uterus, which seems to be a part of the abdominal mass. The blood-count shows a slight secondary anemia with a slight leukocytosis and increased polynuclear cells. The urine is negative except for a faint trace of albumin. Blood urea and phenolphthalein tests are normal and the Wassermann test is negative. Cystoscopic examination (by Dr. MacKinney) is practically negative with the exception of the right kidney, from which there was no indigocarmin elimination. The report reads: Ureteral pressure with back pressure from a neoplasm.

The patient being ready, I will open the abdomen through the right rectus muscle, exposing a large tumor, fibrocystic in type, of the size and shape of a large watermelon. I hope to deliver this tumor intact and will, therefore, enlarge the incision, and with careful and very gentle manipulation I am able to deliver it. You can now see that it is attached low down in the pelvis, evidently having its origin in the right broad ligament. With the tumor thus on end, as it were, I pack off the peritoneal cavity with large, square, moist, warm pads of gauze, which, with the patient in the Trendelenburg position, gives you at will an unobstructed view of the pelvis. I am now able to say definitely that the tumor springs from within the right broad ligament. I am not able to recognize the tubes and ovaries, since they, in reality, form a part of the base of the tumor. In order to extirpate this large mass I will amputate the uterus with the cautery from before backward through the supravaginal portion of the cervix, first cutting through the serous covering of the uterus where it is reflected on to the bladder, and with a small piece of moist gauze pushing the bladder forward, carrying it well under the pubic arch. I now cut transversally through the supravaginal cervix, grasp it with a pair of volsella forceps, making traction upward, exposing the cervical canal, which I at once cauterize with the actual cautery. The cavities of the broad ligaments being open, I will introduce my fingers and enucleate the base of the tumor, which is very easily done. In making this enucleation I am thoughtful of the ureters, which, with the tumor out of the way, you are able to see. As you observe, they are much dilated, which is in keeping with Dr. MacKinney's cystoscopic observations. By gently milking the ureters you will note I can readily empty them. I will now pass my hand up and palpate the kidneys, which I find of normal size, but with some dilatation of the pelvis, as would naturally be expected. I will tie the uterine and ovarian arteries and close the space between the layers of the broad ligaments by carrying a continuous catgut suture from side to side. It remains for me to remove the appendix and, after removing the abdominal pads, restore the intestines to their normal position and close the abdomen. Drainage

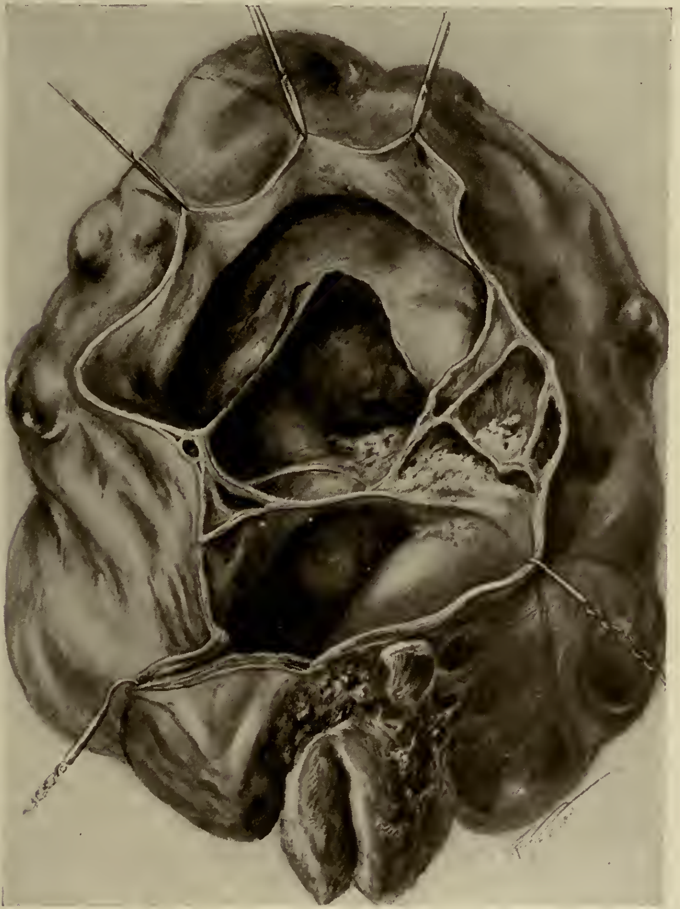

Fig. 2.—Uterus amputated above os, tubes and ovaries included in the base of the multilocular cyst.

is not necessary. This patient will doubtless make a smooth recovery. The tumor was sent to the laboratory. The report reads:

Macroscopy.—Multilocular cysts measure 33 x 20 cm. and contain 4000 c.c. of turbid fluid. Small uterus is firmly attached to cyst and measures 5 x 4 x 3 cm. Endometrium is pale and smooth. No tubes; no ovaries.

Microscopy.—1. Endometrium, atrophied endometrium. 2. Cyst wall, simple multilocular cyst.

CHRONIC CALCULOUS CHOLECYSTITIS

The next patient has been in the hospital several days, with a diagnosis of calculous disease of the gall-bladder. Operation was delayed chiefly on account of faulty kidney function. The patient, a male aged sixty-five years, presents the following history: For the last forty-four years he has been having indigestion, manifested by gas and a feeling of discomfort in the abdomen. Ten years ago he began to have attacks of pain in the upper right abdomen, radiating to the right shoulder and followed by jaundice. The pain often occurred at night, but bore no actual relation to food intake, although at times it was relieved by eating. Two years ago these attacks became more severe, requiring morphin (which hitherto had not been required) for relief; the subsequent jaundice became deeper and the stools were clay colored. He has lost 20 pounds in weight in the last two months. There is no history of spontaneous vomiting. When induced, the vomitus did not contain blood, nor was there any blood in the stools. The patient has recently recovered from one of these attacks. Previous medical history is otherwise negative. The physical examination is negative except for tenderness on deep pressure in the upper right abdomen, no other areas of tenderness being discovered. Blood-count: Hemoglobin, 70 per cent; R. B. C., 3,600,000; W. B. C., 7600; polynuclears, 66; coagulation time, five minutes. Blood urea 12 mgm. per 100 c.c. of blood. Phenolphthalein elimination 16 per cent. in three hours. Urinalysis showed the presence of bile. Although this man has been prepared for operation this afternoon, I must confess I have some hesitancy in proceeding because I have not been able to satisfy myself that there is not an underlying condition of the kidney which may give postoperative trouble. I am reasonably sure, however, that the pathology in this patient's upper right abdomen cannot be relieved in any other way than by operation. The symptoms

—indigestion, pain, jaundice, loss of weight—point to a lesion which warrants operative interference. I have tried to fortify the patient and justify myself by conferring with the director of our pathologic laboratory, Dr. Reimann, as to the significance of the blood nitrogen and the phenolphthalein output. Dr. Reimann is in a position to judge the important question of operation from the laboratory as well as from the practical standpoint, since he has had the opportunity, as he always has, to examine and make a clinical study of this case with us, and can thus draw logical conclusions as to the significance of the above-named conditions.

The patient being ready, I will proceed with the operation. As is my usual practice in cases of this sort, I make the incision through the upper right rectus muscle. Having opened the abdominal cavity, I introduce the index- and middle fingers of my left hand, and determine, as far as I can by touch, the pathology, its location, etc. My fingers are in contact with the anterior edge of the liver which is somewhat contracted. I next try to locate the gall-bladder. There is difficulty in doing this, as the gall-bladder does not seem to hold its normal position in this patient. I have now located it far to the right and holding an oblique position from above downward and outward; this will make its exposure and removal more difficult. The liver is rather small and contracted. I can feel the gall-bladder filled with stones (which confirms the diagnosis of the referring physician, Dr. Evans). I next place the retractors beneath the inner edge of the wound and hand them over to my assistant, who will lift the abdominal walls, which allows me to wall off the operative field. Next, by placing the retractors in contact with the gauze packing and making traction inward and downward, I will bring into view the field of operation with the gall-bladder, the stomach, the duodenum, the hepatic flexure of the colon, and the great omentum united by adhesions. I will sever these adhesions with the fingers and gauze; some are so well organized that I must cut them with the scissors. Separating or severing adhesions requires gentleness in order to avoid the risk of tearing the viscus to which they are attached. Having severed the adhesions, I examine the gall-bladder. There is no doubt that its removal is the proper procedure, since it is enlarged, its walls hard, opaque, and very thin; in fact, there is some degree of calcification of the walls. Before taking out the gall-bladder I will carefully examine the stomach, the duodenum, the pancreas, inspect the lesser peritoneal cavity, palpate the common duct, and the spleen. Not finding anything wrong with these structures, I next expose the cystic duct, with the hepatic and the common duct at their junction, by making a small opening in the right free border of the gastrohepatic omentum, immediately overlying the commencement of the common duct. With the cystic duct exposed, I carry a small pair of curved forceps beneath, and with the end of the forceps lift the duct upward, as you observe. I now grasp the duct at two points with small hemostatic forceps and cut it across with the cautery knife, thus sterilizing both ends of the duct. This I consider a better practice than dividing it with either scissors or knife. Why? Because if there is any infection in the contents of the duct or its walls there is less chance of contamination. Holding the proximal end of the duct with the forceps, I make traction upward and outward, thus facilitating the removal of the gall-bladder; in other words, every step of the operation is in full view of my eye, so that in case of any anomalies I can observe them at once and deal with the condition in the safest possible way. Having lifted up the proximal end of the duct, I separate the pelvis of the gall-bladder from the common duct and the portal vein to which it has become adherent, and now show you the cystic artery. This I clamp, cut, and tie, and complete the removal of the gall-bladder by dissecting it from below upward. You will note the appearance of the fossa or the bed of the gall-bladder. This I will close with a continuous catgut suture carried through the liver, forming the walls and the floor of the bed with the long, round, curved needle which carries the gut. Having completed the suturing, I inspect the under surface of the liver, which, I see, is satisfactory. Next I remove the packing in the subhepatic fossa or Morris' pouch. I take the clamp off the distal end of the cystic duct and pass a probe through it into and through the common duct into the duodenum, when, with the probe in the common duct and the point of it palpable in the lumen of the duodenum, I again palpate the common duct, thus hoping to make sure I have not overlooked a stone in the duct. This, with palpation of the duct, the probe *in situ*, is one of the best means of detecting stones in the duct, yet we may fail to detect a small stone, for it is sometimes difficult to tell whether a very small enlargement (nodule) in the head of the pancreas at the point of its relation with the common duct may not be a stone. Therefore, when still in doubt, I pass a small gall-stone scoop down the duct, when, if a stone is present, upon its withdrawal a stone or some stony material will be delivered. Without this technic the operation for the removal of gall-stones in the common duct will not have been complete. In operating for the removal of a stone in the common duct palpation as well as instrumental exploration is absolutely essential in order to avoid leaving a stone or small stones behind. I must warn you, however, that in exploring the hepatic duct there is a slight degree of risk of carrying a stone into either the left or the right hepatic duct. I have known this to occur. This again emphasizes the paramount importance of carrying out your manipulations with the greatest gentleness. You will note how lightly my assistant handles the retractors, holding them loosely in his hands very much like holding the putter and in putting in playing golf, allowing the wrist-joints and not the forearms to do the work. I wish next to draw your attention to the care necessary in traversing the common duct to gain admission to the duodenum. In many gall-stone cases where the ducts, particularly the common duct, has been involved in the infection and inflammation, the opening in the papilla of Vater will not so easily tolerate having a probe passed through it as when the common duct has not been affected. What I wish to convey to you is that the papilla having been somewhat fussed up by the insult to the common duct, it is more or less irritable, with some spasticity of the muscle of Oddi, therefore when the point of the probe reaches the end of the duct it may be arrested. In these conditions, if you have used a comparatively large probe to start with, you will find it necessary to change to a smaller one or even a very small one, when by proper direction and very little, if any, pressure you will succeed in passing the probe. The small probe can be followed by a larger one and, if necessary, a still larger one. Should there be a small stone in the orifice of the papilla you will probably be able to dislodge it. Again I must warn you against using force, as it is very easy to perforate the wall of the duct. I am sure that I have often displaced the papilla when there was a stricture present.

The common duct being clear and the pancreas and peripancreatic glands being found negative, I will tie the stump of the cystic duct with chromic catgut. I then carry a small rubber drainage-tube down to the stump of the cystic duct, remove the small and large gauze pads, and prepare to remove the appendix, provided I can easily deliver the cecum; this I find I can do. The gauze and instrument count being all correct, the abdomen can be closed in the usual way.

Where there is considerable oozing, instead of placing a rubber tube I introduce a small glass tube, which is kept from overflowing by aspiration with a small glass syringe, to which is attached a piece of rubber tubing long enough to reach the bottom of the glass tube. This is managed by the nurse. At the end of twenty-four hours a rubber tube is carried down the glass tube, and the latter removed by revolving it at the same time it is withdrawn. A word of caution in the use of the drainage-tube: if it is carried down beyond the stump of the cystic duct and into contact with the crus of the diaphragm it will occasionally cause the patient to cough. When this happens the tube should be lifted a trifle and the cough will be relieved.

We have been fortunate here this winter in having no serious postoperative pneumonias. I attribute this in great part to our operating under gas-oxygen (without ether). For the occasional operator this will not answer; much harm can be done if one has not trained himself to work with this anesthetic. In the majority of septic cases, however, gas-oxygen will not suffice, since in order to prevent contamination the necessary relaxation cannot be obtained satisfactorily without ether.

I have remarked that gas-oxygen anesthesia in this class of cases is not the most satisfactory anesthetic to work under. This I admit. My reason for giving it is that the kidneys will not be subjected to irritation and, again, the risk of postoperative pneumonia is practically nil. At this season of the year when influenza and pneumonia are so commonly seen it behooves the surgeon to be more careful. During the winter I have been doing most of my abdominal work under this anesthetic, and am satisfied one can by practice learn to work with this form of anesthetic if he is gentle and patient. There must be absolute co-ordination between the anesthetist and the operator. I do not give ether with the gas and oxygen. Very rarely in a very serious cantankerous patient, where they do not go under the anesthetic nicely, I give a few drops of chloroform, but this is so seldom done that it does not figure.

You will observe that I did the greater part of this operation under gas-oxygen anesthesia, about the meanest anesthetic to work with in the abdomen. I was afraid to give this patient ether on account of the poor kidney function. In the after-treatment special attention will be paid to the kidneys. I will tell his friends we have found two conditions, diminished kidney function and a contracted liver, both of which make the prognosis less favorable than it is in the majority of cases.

Before presenting the next patient I wish to say a word about the presence of jaundice as it occurred in this patient in the absence of stone in the common duct. This is not infrequently seen, and is due to an extension of inflammation to the liver by way of the cystic duct or by way of the lymphatic connection between the gall-bladder and the liver, and in either event to cholangitis; or to inflammatory obstruction of the common duct, to extension of the infection by the way of the lymphatics to the peripancreatic lymph-glands, or to the pancreas, causing enlargement of these and consequent obstruction of the common duct. The occurrence of jaundice in gall-bladder cholelithiasis is the exception, not the rule, as in common duct cholelithiasis.

RECURRENT CHOLELITHIASIS

The patient now being wheeled into the amphitheater is a man forty-seven years of age, who was sent in for operation on account of jaundice and clay-colored stools. This man has a history of typhoid fever twelve years ago. He had been a patient on the surgical service of this hospital from March 2 to April 25, 1921, with a diagnosis of biliary calculus, chronic pancreatitis, and chronic interstitial cholecystitis. The operative findings at that time were: Duodenum adherent to the liver; stomach and pylorus normal; liver overlying the gall-bladder, which contained stones; hard adhesions between the hepatic flexure of the colon, the duodenum, and the great omentum; common duct indurated and dilated, clear yellowish bile obtained by hypodermic aspiration. Glands along the common duct and around the head of the pancreas enlarged, hard, and nodular. When the gall-bladder was removed the posterior wall was found to have been ulcerated through by a gall-stone that lay in the gall-bladder bed. The common duct was opened, probed, and drained with a rubber T-tube and an additional small rubber tube carried into the subhepatic fossa. A part of the free portion of the great omentum was placed between the sutured gall-bladder fossa, the pylorus, and the duodenum. The wound was closed in the usual way. A chronically diseased appendix was removed through a McBurney incision. Recovery was uninterrupted. The T-tube was taken out thirteen weeks after operation. The patient remained perfectly well until Thanksgiving, 1922, when he developed what was diagnosed rheumatism of the back and the midlumbar region. Following this he developed severe pain throughout the abdomen, requiring several hypodermics of morphin for relief. Several days following this attack the patient became jaundiced; the urine became dark and the stools clay colored. The onset of jaundice was preceded by chills, fever, and sweats occurring during the night and morning. On admission the patient complained of slight pain referred to the right hypochondrium, some degree of jaundice, stools still clay colored. Blood-pressure, 105/60. Phenolphthalein and blood urea tests are practically normal. Urine contains bile, albumin, and granular casts. Diagnosis: Calculous obstruction of the common duct. I will begin by cutting out the scar of the previous operation and cautiously open the abdomen at this site. I next expose a rather conglomerate-looking mass composed of the lower portion of the right lobe of the liver, the hepatic flexure of the colon, the duodenum, and the stomach. First I free the great omentum, which, you can see, is uniformly adherent to the parietal peritoneum and the above-mentioned parts. I have released the omentum with the exception of the portion interposed between the liver and the adjoining structures. This quite well exposes the hepatic flexure, which holds a high position owing to its being tightly adherent to the lateral peritoneal wall and the under surface of the liver. Freeing it is rather difficult because of my desire to prevent injury to the bowel. Fortunately, I have succeeded. I now displace the flexure downward and at the same time protect it with a layer of moist gauze against which my assistant will place the retractor in order to hold it out of the way, so as to expose the under surface of the liver to which are attached, as you now observe, the great omentum, the stomach, and the duodenum. I next attack these organs and show you the right free border of the gastrohepatic omentum and the head of the pancreas embraced by the duodenum. This gives me an opportunity to examine the pancreas, which I find to be normal in size and consistency. I will ask my assistant to grasp the head of the pancreas with the duodenum, also carefully to palpate the body of the pancreas, and ask him what his impressions are. Answer: Normal gland. This clearly proves the good effect obtained by the prolonged drainage following the previous operation. You will observe that by drawing the liver outward I now pass the point of my right index-finger through the foramen of Winslow. Between the layers of the omentum at this point are the common duct, the hepatic duct, the portal vein, and the hepatic artery. The structure farther to the right, therefore nearest to me as I stand on the right side of the patient, is the common duct. The duct is very clearly seen in this instance, somewhat larger than normal, with rather opaque walls due to the injury it sustained prior to the first operation. To prove that this is the duct, I aspirate it and obtain bile. You will further note that as I roll the duct forward and upward I expose the portal vein. I next palpate the duct rather low down, when I feel a hard body which, with the point of my finger, I am able to carry up into the more accessible first portion of the duct; this evidently is a stone, which I am able to remove by holding it in position and dividing the walls of the overlying duct. Having removed this rather large stone, I pass a small gall-stone scoop down into the duct, and upon withdrawal of the scoop I find I have removed another stone. Again I examine the duct by carrying the end of the scoop through the duct down to and through the papilla of Vater. I next carry the scoop up into the main hepatic duct and the two primary branches, but find nothing. I will drain the common duct with a rubber T-tube. With the tube *in situ* the incision in the duct wall is closed on either side of the vertical branch of the tube. Next I carry a small rubber tube into the subhepatic fossa, remove the gauze pads, and close the wound.

The chief points of interest in this case are: The recurrence of symptoms after a previous operation for the relief of a condition somewhat similar to the present; also the finding at the first operation of chronic pancreatitis with chronic pancreatic lymphangitis, which cleared up entirely after drainage of the common duct for thirteen weeks; chronic choledochitis, chronic circumscribed hepatitis with an underlying diseased gall-bladder, together with enlarged glands along the common duct; and the fact that the patient remained well until the common duct became obstructed by a stone. The diagnosis of the present illness was much easier than of the former condition, the pain, chills, fever, sweats, and jaundice being typical of stone in the common duct.

The more commonly ascribed causes for recurrence of symptoms after operation for gall-stone disease are overlooked stone or stones, adhesions, injury to the ducts resulting in stricture of the duct or cutting of the common or the hepatic duct at operation and failure to have recognized and repaired the rent. In the late cases, in the absence of marked jaundice, pathology in the peripancreatic glands and the pancreas itself is the most common cause of the recurrence. The second most common cause is adhesions of the structures in apposition with the original field of operation. The cases presenting gall-stones at the second operation are, in my experience, those in which the gall-bladder had been drained at the first operation.

In the experience of this clinic prolonged pathology is the most common cause. In other words, failure to make an early diagnosis, or, having made the diagnosis, procrastination in advising surgical relief. The internist occasionally tells us much of his clinical material is made up of patients suffering from recurrence of symptoms following operation for gall-stone disease and ulcer. The answer is: So many of the patients for which either of these operations have been made were long sufferers before operation; in other words, the diagnosis was not made early enough for early operation. Late operation, better, of course, than no operation at all, reveals late pathology—pathology which is no longer confined to the point of the original focus, but extended well beyond the point involving adjacent structures, in the shape of chronic pancreatitis following medically maltreated gall-bladder disease. Medical treatment cannot cure a chronically infected gall-bladder or an old chronic ulcer.

I will now discuss a few operative histories presenting points of interest and of value to the inexperienced as well as to the experienced among you.

DIFFERENTIAL DIAGNOSIS: ACUTE APPENDICITIS *vs.* ACUTE PANCREATITIS

This case, a woman sixty-three years old, was admitted with a diagnosis of acute appendicitis. Upon the morning of the day of admission she was seized with acute epigastric pain which soon became cramp-like and generalized. The patient took a dose of castor-oil, which she promptly vomited, but did not vomit after this. Examination showed a distended abdomen and very little peristalsis, audible only in the upper abdomen. There was general abdominal tenderness most pronounced in the lower right quadrant, also generalized abdominal rigidity. Breathing was chiefly thoracic. Examination of the chest proved practically negative with the exception of a few moist râles at the angle of the right scapula; heart sounds poor, no murmurs. Vaginal examination negative except for slight tenderness in the fornices, more marked, if anything, in the right fornix. Rectal examination negative. There was some pain with tenderness over the region of the left kidney. Blood examination on the day of admission: No anemia; white cells 15,000, and polynuclears 74; three days later leukocytes 13,000, with polynuclears 69; and eight days after admission leukocytes 20,700, with polynuclears 64. Urine normal. Phenolphthalein, blood nitrogen, Wassermann, and blood-sugar tests normal. Cystoscopic examination negative. The temperature and pulse-rate slightly increased. Blood-pressure is 155/80. This patient was not operated until ten days after her admission, as we were not at all sure of the diagnosis, and operation did not seem urgent.

At the operation a low incision was made through the right rectus muscle; extensive fat necrosis was found, also a chronically diseased appendix, which was removed. Operative diagnosis: Acute pancreatitis.

This patient made an uninterrupted recovery. This case demonstrates some of the pitfalls in abdominal diagnosis, and that acute pancreatitis is not necessarily fatal if not operated upon. But it must be remembered that all cases of acute pancreatitis do not terminate so happily as this one.

SUBACUTE PANCREATITIS

Male, aged forty-six years, was admitted to this clinic with chief complaint of pain in the epigastrium. Six weeks before admission while at work he developed sudden severe, sharp pain around the navel, followed immediately by collapse. He was at once taken to another hospital, where he remained until a day or two before coming here. After recovery from the acute symptoms he continued to have intermittent paroxysms of pain. There was no history of vomiting or jaundice. Upon admission he still complained of a constant dull ache in the upper midabdomen. He gave a history of two previous similar attacks, one in 1917, the other within the last year; there was no history of chronic indigestion. In both of these attacks the patient was shocked and remained under treatment for ten days. When well he eats much and drinks rather freely. No urinary symptoms except nocturia. Blood-pressure 115/78. Examination of blood and urine negative. Stomach analysis negative; kidney function normal; blood-sugar, 250 mgm. per 100 c.c.; Wassermann negative; *x*-ray, persistent deformity in the duodenum, suggestive of ulcer. Physical examination negative except for epigastric tenderness and slight rigidity to the left of the epigastrium, with an indistinct palpable mass. Diagnosis: Subacute pancreatitis.

The patient was prepared for operation, intraspinal novocain anesthetic, 11 centigrams, was given. The abdomen was opened through an upper right rectus incision, revealing extensive fat necrosis, enlarged pancreas, and a chronically diseased gall-bladder. The gall-bladder was drained. Shortly after operation the patient developed symptoms of respiratory failure attributed to the novocain; artificial respiration, intravenous saline with pituitrin, atropin, and caffein hypodermically, and the administration of oxygen were of no avail, and the patient died.

These 2 cases are of interest from a diagnostic standpoint. The first one did not present any symptoms warranting a diagnosis of the real lesion, while in the second one the diagnosis seemed to us comparatively clear. In neither case was there the persistent vomiting, rapid and weak pulse, cyanosis or lividity of the skin, as usually associated with acute pancreatitis. In the first patient there was no history of depression or the pain severe enough to be charactertic, while the second patient presented marked depression following the very acute pain, with marked local signs which were absent in the first. In the first patient there was a decided leukocytic reaction after several days, while in the second patient the blood was negative. This I believe will impress you with the unreliability of laboratory findings in some cases, and of the importance of the physical findings. The question of anesthesia comes up here. If we had given ether or a general anesthetic to the second patient we might not have had a fatality, certainly not an immediate one. In intraspinal anesthesia, I care not what drug is used, the patient is exposed to the greater danger of immediate death. You frequently have heard me discourse on the trials, tribulations, and joys of a surgeon. This is one of his tribulations.

I have no doubt that cases similar to the second patient are more common than is generally believed. I am of the opinion that many of the conditions diagnosed acute indigestion, where the patient has a history of having eaten rather excessively, is stricken with sharp, acute epigastric pain, followed by depression which lasts only for a short time, and recovers in five or six days, are, in reality, instances of mild pancreatitis. The pathology in these cases is a very slight, usually only punctate hemorrhage into the pancreas. In practically all of these cases a very careful physical examination and study will reveal, in addition to the epigastric fulness, tenderness and often an indistinct palpable mass, a chronically diseased appendix or gallbladder.

SEQUELÆ OF SUPPURATIVE APPENDICITIS

The last case I will discuss with you this afternoon is that of a boy fifteen years old, admitted several days ago with suppurative appendicitis, who, in addition to the primary operation for the appendical condition, underwent two further operations for right-sided empyema and intestinal obstruction. This should impress you with the danger attendant upon appendicitis advanced to the suppurative stage. In fact, the pathologic possibilities of acute appendicitis have no limitations; among the more serious ones are: Peritoneal toxemia, secondary abscess, intestinal obstruction, pyelophlebitis, septic pneumonia, empyema, hemiplegia, phlebitis, and parotitis. In this clinic, where we have many cases of suppurative appendicitis, we are constantly meeting with one or another of these conditions, therefore let me warn you to advise operation in acute appendicitis at the earliest possible moment, before the peritonitis has gotten beyond the site of the appendix.

This boy, who has been having some abdominal discomfort, was accidently struck in the abdomen while playing at school, three days before admission. The same night there was a recurrence of the pain in the lower abdomen, and the next day the pain was generalized over the entire abdomen. The day before admission the pain became more and more severe, and then localized in the lower right quadrant. He was given a dose of magnesia, which was followed by several evacuations. On admission to the hospital there was generalized abdominal rigidity with considerable distention, pronounced general tenderness, absence of peristalsis, increased pulse-rate, and temperature. He was thereupon put upon anatomic and physiologic rest, the Murphy drip, ice-bags to the abdomen, and morphin just enough to keep him free from pain. After twenty-four hours, there being a definite localization in the lower right abdomen, operation was performed.

A perforated appendix was found with pus along the outer side of the colon, in the subhepatic space, and in the pelvis. Separating the liver from the overlying abdominal wall resulted in the discharge of a large amount of puruloid material, with a rather definite color and a colon bacillus odor; the pelvis was filled with colon bacillus pus. All infectious areas were thoroughly drained and the wound left open.

The boy went along satisfactory for two weeks, when the respirations increased, breathing became embarrassed, together with pain referred to the upper right abdomen and the lower right chest, accompanied by a rise in temperature and increased pulse-rate. This continued for two days, when by careful physical and fluoroscopic examination fluid was demonstrated in the lower right pleural cavity.

The second operation consisted of drainage and the removal of about 2 inches of the tenth rib, with liberation of a large amount of pus. After this the boy did well for seventeen days, when he developed acute, intermittent abdominal pain, with exaggerated peristalsis, vomiting, etc., leading to a diagnosis of acute abdominal obstruction. The third operation revealed coils of small bowel adherent to the overlying parietal peritoneum at the site of the previous operation and to one another; these adhesions were severed and the abdomen closed. Following this the boy recovered slowly, but completely, and was discharged with a granulating wound sixty-six days after admission. The empyema was evidently caused by ascending infection from the abdomen, through the diaphragm by way of the lymphatics.

In this connection and before dismissing you I would like to say a word about appendical peritonitis. Appendical, like all forms of peritonitis, is bacterial in origin, the most common organisms present being the colon bacillus and the streptococcus, the severity of the peritonitis depending upon the character of the infection.

Acute appendicitis always causes a peritonitis, and the seriousness of appendicitis depends entirely upon the extent of the peritoneal inflammation and the type of infection. On first seeing the patient we, of course, satisfy ourselves of the diagnosis of acute appendicitis. Our chief concern is the degree and the extent of the peritonitis, the general appearance of the patient, and the reaction to the peritoneal infection, as determined by the pulse-rate, the character of the pulse, the temperature, the blood-pressure, the leukocytic and polynuclear count, and what can be learned by careful examination of the abdomen. In the presence of a peritonitis I carefully examine the abdomen, noticing how it is influenced by the excursions of the diaphragm during respiration, then auscult, and next gently percuss and palpate. I then have the patient breathe deeply, short of causing him marked pain, then let him cough, hoping to get some idea of where the soreness is most marked.

Peritonitis is frequently described as local, diffused and general, or universal. Practically, I believe it best to speak only of circumscribed and diffuse. The differentiation of these varieties ordinarily is not difficult, and can usually be determined by the area of rigidity or tympany, or both, the extent of tenderness and the difference in the degree of peristalsis over and around the inflamed area, as learned by auscultation. The stumbling-block occasionally is peritoneal irritation, which, when present together with a circumscribed peritonitis, is not always easy to differentiate from a diffused peritonitis. The most reliable points in making the differentiation are the degree and extent of tenderness and rigidity and the presence of exaggerated or normal peristalsis. The type of the infection makes little difference from the operative standpoint since, other things being equal, the earlier the operation, the better the result, and vice versa.

The character of the inflammatory exudate, whether serous, serofibrinous, or purulent, is of moment only with regard to the institution of drainage. When there is a purulent and especially a foul-smelling exudate the method of choice is free drainage, often with the wound left open. The preferable drains are the Mikulicz rubber tube, and occasionally a glass tube, cigarette drains, plain sterile gauze, and large pieces of rubber-dam. In order to wall off the infected area or the abscess cavity I occasionally introduce a large piece of rubber-dam circumferentially and gently pack the cavity loosely with sterile or iodoform gauze. Clinical differentiation between the different kinds of exudate is not always possible, although exquisite tenderness is significant of the presence of pus and is of much greater moment than leukocytosis. The most important lesson I wish to convey to you is when to operate in acute appendical peritonitis. I say operate upon all cases in the presence of circumscribed peritonitis when able to localize the lesion. In diffused peritonitis in a patient sick three or four days, where the lesion cannot be localized, treat by anatomic and physiologic rest, lavage, enteroclysis, intermittent or continuous hypodermoclysis, the object being to get plenty of water into the system without waterlogging the intestines; cold applications to the abdomen, morphin to relieve pain and produce sleep. To the enteroclysis may be added whisky, or expressed beef juice, or liquid beef peptonoids, etc. Hypodermic stimulation, caffein, strychnin, digitalis, and camphorated oil are useful where the depression is pronounced.

In cases of diffuse peritonitis, where the patient is not very ill and the lesion can be definitely localized, immediate operation is indicated.

I am continually receiving inquiries as to the proper time to intervene in cases of peritonitis. I believe the point is well illustrated in what I have just said. In spite of the comparative frequency of acute appendicitis and the wide and general discussion of this subject, it still remains one of the serious and perplexing problems of surgery. Experience and good judgment are nowhere of greater value than in this so apparently common ailment, and yet more mistakes are probably made in this type of cases than in other less common disorders.

CLINIC OF DR. CHARLES H. FRAZIER

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SOME OF THE SURGICAL PROBLEMS IN THE MANAGEMENT OF PITUITARY DISORDERS[1]

AT this time I want to bring before you a series of cases illustrating disorders of the pituitary body and discuss more particularly the indications for and the results of operative interference. Let me say, by way of preface, that the surgeon is called upon chiefly to relieve pressure and, in the case of a pituitary disorder, the pressure phenomena are confined practically to the optic tracts, the optic chiasm, or the optic nerves, differing thus from the effects of intracranial pressure in tumors of the brain where headache is one of the almost constant subjective disturbances.

Before reviewing individual cases let me say a few words as to the variety of lesions with which we have to deal and with which we should be familiar in the management of the individual pituitary patient. In this discussion of the surgical aspects of pituitary disorders we will recognize three groups:

Group 1.—The first and by far the commonest is the adenomata, representing probably 80 per cent. of pituitary lesions. These adenomata are primary growths, and while the clinical expression of the lesion may vary according to whether we are dealing with the adenoma chromophobe, with hypofunction, or the adenoma chromophil, with hyperfunction, is a matter of no practical surgical importance, as the indications for operation, in so far as visual disturbances are concerned, and the method of attack, in so far as the approach is concerned, would be quite the same.

Group 2.—In Group 2 we include lesions which, while in most instances distinctly suprasellar, at least have an anatomic association with the pituitary structure; we refer to tumors of the pouch of Rathke and tumors of the hypophyseal duct. Both lesions are frequently associated with cyst formation, but are quite different in structure. In the hypophyseal duct tumor we find papillary squamous epithelial cysts, frequently calcified, whereas in the tumors from Rathke's pouch the cyst wall is lined by a single layer of ciliated cylindric epithelium. Later on I will show you patients illustrating each of these two lesions.

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[1] A clinic on Disorders of the Pituitary Body delivered to the students of the Graduate School of Medicine.

Group 3.—Under this group we include suprasellar growths, which while not of pituitary origin, at the same time frequently give rise to pituitary symptoms. These might properly be called neighborhood tumors, and included therein would be the tumors of the third ventricle, or choroid plexus, endotheliomata taking their origin from the basal meninges and in some cases deep-seated gliomata.

Symptomatology.—I will not attempt in the alloted time to review the symptomatology of pituitary disorders. You well know that there are two distinct types: one with acromegalic features, the other exhibiting the so-called Fröhlich's syndrome, but let me remind you that in many instances the line between these two types is not always sharply drawn. In a number of cases there is overlapping, and not infrequently the clinical picture combines features of both types of the disease. But, as already said, as surgeons we are particularly and almost exclusively interested only in the visual disturbances. The patient consults the surgeon either to conserve vision or to restore vision already lost. While the characteristic picture of pituitary disorder when fully developed is the bitemporal hemianopsia, this is by no means constant. In the early stages one sees only quadrant defects. It is, furthermore, characteristic of the visual disturbances of pituitary that the process is more advanced in one eye than the other. Should the lesion have advanced to the point of optic atrophy, which inevitably follows unless pressure be relieved, such atrophy is more advanced in one eye than in the other, so much so that in many cases that come to this clinic, in at least 50 per cent., if not more, the patient is already totally blind or virtually so in one eye, and it is not until loss of vision is threatened in the other that the patient becomes alarmed and consults the surgeon.

Radiography.—Routine examination of the patient with the *x*-ray is essential both as an aid to diagnosis and as a guide to treatment. In the first place, we must distinguish between the sellar deformations of the primary intrasellar lesions and the suprasellar growths. The primary intrasellar growth gives the characteristic deep cup-shaped excavation of the sella, with atrophy and erosion of the sellar floor. The suprasellar growth, on the other hand, presents a very different picture. In most cases there is no enlargement or deformity of the sella, but the posterior clinoid processes have disappeared from atrophy and the sella appears elongated, but not deepened, in its dimensions. There are other things to be learned from the *x*-ray. For example, you may see in the case of hypophyseal duct tumors sharp definition of the tumor or the cyst wall, which is revealed in the *x*-ray pictures of the calcareous deposits, and the same shadow may be seen in tumors of Rathke's pouch. We make it a habit to inspect in the *x*-ray plate the sphenoid sinus; as the sella enlarges downward it encroaches upon the sinus, and in some instances you will find that the sphenoid sinus is practically obliterated. This bit of information is of value to the surgeon before the operation, in that it gives him a clue as to the prognosis or, rather, as to what may be anticipated from the so-called sellar decompression; after the lesion has already decompressed itself sufficiently to obliterate the sinus but little relief should be anticipated from a decompression alone. To relieve pressure a considerable portion of the lesion must be removed. It would take us too far afield to discuss the interpretation of the ventriculogram in suspected suprasellar growths, but in doubtful cases we may at least be able to eliminate tumors of the third ventricle if, as in the case from which this *x*-ray picture was taken, we find the third ventricle distended with air. Very briefly these are the important points of information to be derived from the roentgenologic study of the individual case.

Treatment.—Now for the main theme of this morning's demonstration. What treatment would you recommend for a patient with pituitary disease referred to you with failing vision? You will probably find that in the majority of cases the patient has already had a course of glandular feeding. This is the popular method of dealing with this emergency when it arises, but how often it is effective I am not prepared to say. In practically all our cases this treatment has been employed for a longer or shorter period before the patient has been brought to us for observation. From what I hear, however, I am rather disposed to believe that the response of pituitary adenoma to glandular feeding is only of exceptional occurrence. The glandular extracts could, of course, have no effect upon lesions other than those of the adenomatous type. There remain to us for consideration but two therapeutic measures—radiation by *x*-ray or radium and operation. Whether or not you should be content to postpone operation in favor of radiation will depend in large measure, if not entirely, upon the visual disturbances. We must recognize a distinction in the visual disturbances between the effect of nerve pressure or nerve stretching, such as might produce a hemianopsia, and the effect of more prolonged pressure which eventuates in an optic atrophy. Given a case in which there is complete optic atrophy of one nerve, and this is a very frequent circumstance, and a partial atrophy of the other, operation should not be postponed unless the patient fully understands that further delay may result in total blindness. If the case be of shorter duration and pressure phenomena have not advanced to the point of optic atrophy, admitting a bitemporal hemianopsia, it is perfectly proper, providing the patient is under the observation of a competent ophthalmologist and providing treatments be carried out by one familiar with the technic of radiation in pituitary lesions, under these circumstances to try the effect of *x*-ray or radium.

x-Ray.—A word should be said here, I think, in regard to this effect of radiation in pituitary lesions. Because of the distortion of the visual field, characteristic of pituitary lesions, we have a very tangible index by which to determine the effectiveness, or ineffectiveness, of any method of treatment. It is not a matter of guesswork, so that one can say positively in any given case whether treatment by radiation is or is not effective according to whether the visual fields enlarge or remain stationary. Béclère must be credited with the institution of this method of treatment, and he has had under his observation a series of some 40 cases, which he reports favorably influenced. This is probably the largest series on record, but in our own clinic we have had results in a smaller series of cases, but sufficiently striking, to warrant our faith in radiation particularly as a protection against recurrence after operation, but in a few cases as an active agent in the treatment of recurrences. The following may be cited as an illustration:

X., aged thirty, was referred to me because of recurrence of visual disturbances following a subsellar decompression performed about one year before she consulted me. She has in both eyes a bitemporal symmetric scotoma, and in addition to this she complains more or less constantly of headache; incidentally she has not menstruated for a number of years. Before a second operation could be considered with propriety I thought we should try the effects of radiation. To make a long story short, under this treatment the headaches subsided, menstruation was established, and the bilateral scotoma entirely disappeared. She has been free from recurrence now some five years. We have in this case then conclusive evidence of the beneficent effect of radiation upon a recurring lesion.

As another example of the favorable influence of radiation I present this patient: E. S., aged nineteen, File 66,933, was referred to me by her physician for headaches and failing vision. A roentgenogram showed a sella turcica the dimensions of which were just a little beyond what we consider as normal. There had been a rather rapid deterioration of vision in the last few months and there was a decided cut in the field of the right eye. There were no other stigmata of pituitary disorder, but from the *x*-ray and eye findings a diagnosis of presumptive pituitary disorder was made, and the patient referred to Dr. H. K. Pancoast for radiation. The patient has received three courses of treatment, as the result of which her vision has decidedly improved, the cut in the visual field of the right eye has almost entirely disappeared, and with it her headache. The patient has received no other treatment, and it would seem reasonable to assume from the sequence of events that our original diagnosis was correct and treatment appropriate.

Surgical Problems.—We have by no means arrived at the point in the development of pituitary surgery at which there can be said to be well-defined and generally accepted indications for the selection of one or the other of the two operative procedures by which the lesion is approached. I refer to the transsphenoidal operation, essentially an extracranial procedure, and the transfrontal operation, essentially an intracranial procedure. Which of these two methods should be the method of choice? The question cannot be answered in this general way. We have to take under consideration whether the lesion belongs to one or the other of the two general groups, namely, the primary intrasellar lesion, the extrasellar or essentially suprasellar lesion, such as the hypophyseal duct cysts and the tumors of Rathke's pouch. There is no difference of opinion so far as I know among neurologic surgeons as to the propriety of the transfrontal approach when, as in this case, there was no doubt that we were dealing with a suprasellar lesion. This boy, J. E., aged seventeen, File 63,423, evidently presents the picture of pituitary disorder. His growth was arrested at the age of ten; there are evidences of infantilism; he has had periodic attacks of headache and vomiting; there is total blindness in the left eye and hemianopsia in the right. This roentgenogram shows clearly the outline of the calcified suprasellar lesion. Clearly the proper avenue of approach in this case was by the transfrontal route. A flap was reflected, the anterior horn of the ventricle tapped, the frontal lobe elevated, and with the head in the Rose position the tumor was readily exposed. Although at first it was thought to be a solid growth, it was found later to be a cyst the wall of which was unyielding because of its calcification. The cyst contained about 80 c.c. of a dark reddish fluid. As much as possible of the cyst wall was removed, the lining of the cavity which remained swabbed with 30 per cent. iodin solution, and the operation concluded with closure of the dural and osteoplastic flap. The precise nature of the cyst is undetermined; whether it originated in the hypophyseal duct is a matter of conjecture, because upon histologic examination there was no evidence of any epithelial lining; nothing but fibrous tissue with calcification could be demonstrated. It is reasonable I think to assume, however, that the findings might represent a terminal stage of a process in which the epithelial structure had been replaced with fibrous tissue.

While considering the question of suprasellar lesions, let me present this patient, who happens at the time to be under observation at the hospital. She has, I believe, a suprasellar tumor, possibly a tumor of the pouch of Rathke. We have at least a very definite shadow in the *x*-ray of the calcified growth occupying a position immediately over the sella turcica. While I hesitate to make a positive diagnosis as to the precise nature and precise origin of the growth, I am at least willing to say that, should there be indications for operative intervention at this time, I should recommend unhesitatingly an operation by the transfrontal approach, because as you see in the *x*-ray film there is no enlargement of the sella turcica itself, but the shadow of the tumor lies immediately above. The patient presents some interesting features.

Miss X., aged fifty-five years, has been complaining for the past four years of visual disturbances. She has not menstruated since she was twenty-six years of age, and when thirty-five she was told that the pelvic organs were infantile in type. More recently her vision has become more defective. She complained of pain in the eyes and headaches, and was sent to the Neurosurgical Clinic for an opinion as to whether or not an operation was indicated. The following were the positive findings in the history and physical examination: Headache and drowsiness; marked cutting in the temporal fields for both the 10 and 3 m. disks, with some pallor on the temporal side of the disks; paresis of the right inferior oblique muscle; vision of the right eye 20/50 with glasses, and of the left eye, 20/30. The pituitary symptoms are represented by drowiness, hemianopsia, and a lowered metabolic rate (—51 per cent.). The *x*-ray shows a normal sella turcica and the shadow of a calcified tumor directly above the sella. She is receiving 3 grains of pituitary extract and 1½ grains of thyroid extract daily with intensive radiation.

The patient has been under observation four months, and during this time there has been no further deterioration of vision. She has had less headache and less drowiness and the metabolic rate has risen from —51 to —29. The latter, considered with other evidences of improvement, must be attributed to the effects of the combined *x*-ray and glandular treatment.

These 2 cases illustrate very well the type in which a transfrontal operation should be the operation of election, and this brings us to the consideration of the primary intrasellar lesions, identified by the characteristic cup-shaped excavation of the sella. When confronted now with this condition invariably I practice the transsphenoidal operation, followed in all cases by intensive radiation, with the understanding that should there be a recurrence of symptoms, as there may be, a secondary operation by the same approach may be performed, or, preferably, a transfrontal operation. I am quite willing to admit that in a certain number of cases the tumor may already have grown beyond the confines of the sella turcica and become in part at least a suprasellar growth, and I recognize, too, the difficulties in determining in any case whether or not at the time of operation and to what extent the lesion may have grown beyond the limits of the sella turcica. But, granting this, I still maintain the transsphenoidal is the operation of choice if for no other reason than because the risk is measurably less than that of the operation, which approaches the lesion from above. This statement is based on my own experience and on the reports from other clinics. It is significant that for the past three years we have not had an operative fatality in the transsphenoidal series. On the other hand, we have had a number of deaths from transfrontal explorations, and the mortality of those who routinely practice transfrontal operation has been acknowledged as 40 per cent. Comparing these two methods on the basis of the mortality alone, there can be no question, considering our obligation to the patient, as to which of the two should be the operation of choice.

During the convalescent period and before discharge the patient is referred to Dr. Henry K. Pancoast for radiation. He then assumes charge of the case and directs the patient's return for treatment at certain specified intervals. This patient has returned for this purpose. Three years prior to his admission to the hospital he began to have headaches, chiefly frontal and bilateral, usually associated with nausea and vomiting. About one year ago he noticed some blurring of vision in the left eye, which progressed so rapidly that in a few months vision in that eye was entirely lost. During the past three months his headaches have increased in severity and frequency, until recently they have become almost daily occurrences and are associated always with vomiting. The following are the interesting features of his record: Drowsiness, headache, vomiting, optic atrophy complete in one eye, and a hemianopsia in the other; the *x*-ray shows a sellar deformation typical of a primary intrasellar lesion. Before the operation there was tenderness on pressure in the left temporofrontal region and a herpetic eruption at the angle of mouth and lower lip. At the operation a pituitary cyst was evacuated and the cyst cavity swabbed with tincture of iodin.

Pituitary cysts are the most unfavorable lesions with which we have to deal. Evacuation of the cyst is of itself not always sufficient to ensure permanent results, because there is always the possibility of a cyst refilling with recurrence of symptoms. Just how this lesion should be dealt with is for the present undecided. Total extirpation of the cyst wall is not easy of accomplishment and could only be done by the direct transfrontal exposure. I would not leave you with the impression that these cysts always refill. I am reminded of a boy of seven, who was under observation in this clinic in April, 1918. At that time he had complete optic atrophy of the left eye and a temporal hemianopsia of the right eye, with characteristic deformation of the sella turcica. A transsphenoidal operation was performed, a cyst evacuated, and a portion of the cyst wall removed. There was complete restoration of vision in the left eye, with relief of headache, and there has been no recurrence since.

Prognosis.—The efficacy of any plan of treatment should be evaluated by the immediate mortality, the degree of improvement, and the incidence of recurrence. We have already referred to the operative mortality and told you that by the transsphenoidal method it had been reduced in our clinic in the past three years to zero. There has been improvement in vision in 75 per cent. of our cases. The failures are attributed to the advanced stage of optic atrophy, to insufficient evacuation of the sella contents, or to a lesion that had extended well beyond the confines of the sella turcica. The period of relief without recurrence would, of course, vary under different circumstances. With the routine employment of radiation after operation we confidently expect the incidence of recurrence to be materially reduced. We have employed this combined treatment in the clinic for only three years, so that we must wait until a longer period has elapsed before drawing conclusions as to end-results.

Résumé.—Looking back over the past ten years, in which time most of the history of pituitary surgery has been written, we can, I think, point to certain very definite accomplishments. In the first place we have been able to differentiate with greater certainty between the primary intrasellar lesion (1) the adenomata, so-called; (2) the suprasellar tumors of duct origin, and (3) the so-called neighborhood or adjacent tumors. We have been able to lay down certain indications for the performance of one or two prescribed surgical methods of dealing with pituitary lesions. We have improved the technic of the transsphenoidal approach so that the mortality has been reduced from 17 per cent., or higher, as it was when the operation was first introduced, to zero, as now practised. In the performance of the transsphenoidal operation particularly many difficulties have been overcome by the use of direct illumination. We have learned the possibilities of direct radiation over pituitary lesions, particularly the adenomata. There are on record a number of cases in which by radiation alone visual and other disturbances have subsided, and by combining operation and radiation we hope to prolong the period of improvement and possibly prevent recurrence. Taking it all in all, this period of ten years has been singularly productive.

CLINIC OF DR. ASTLEY P. C. ASHHURST

Episcopal Hospital

CASES ILLUSTRATING THE SURGERY OF THE STOMACH

I want to bring before you this morning a series of stomach cases from which I think we may learn valuable lessons.

Case I. Detachment of a Gastrojejunostomy.—The first patient, a man forty-three years of age, entered the hospital September 14, 1922. He had never been sick until nine or ten years previously, when he developed pain in the abdomen and vomiting. Since that time he had had four different abdominal operations, and was still very badly off; in fact, I believe he was worse then than he was before the first operation. His first operation, done through an upper right rectus incision, about nine years ago, it is said, revealed no lesions, but five weeks later a second operation was done, and at that time through a left rectus incision a gastrojejunostomy was done. He remained well for only four months, when he returned to the hospital and was in that hospital, off and on, almost every year since that time up to August, 1921, when a third operation was done, which he says is recorded by an incision over his gall-bladder region, but he says that the gall-bladder had nothing wrong with it. Again, he felt better for a while, but in June, 1922 he came into the Episcopal Hospital then presenting already the three upper abdominal incisions and complaining of the same old symptoms. At that time my colleague, Dr. Mutschler, did an exploratory laparotomy through an incision in the left semilunar line from the costal border downward. He found innumerable adhesions, and after working for two hours abandoned the operation. After this the man felt well for about two weeks only. Since leaving the hospital in July he had had much pain and vomiting and had been in bed most of the time, and had been able to secure relief only through frequent doses of morphin. So then he came back to the hospital, as I say, in September, when he came under my care. He was a fairly well-developed man, but seemed in constant pain and was vomiting almost continually thin, greenish, mucoid material. His heart and lungs were negative, as was his blood Wassermann and his urine, except for a few hyaline and granular casts. His normal weight, he said, was 147 pounds; he weighed then 132 pounds, so that he had not lost much weight in spite of his long illness. The abdomen showed between the costal margins and the umbilicus the four longitudinal scars already described, and the rest of the abdomen was negative. Naturally, I was very averse to the thought of doing any other operation on such a patient, but he had real, severe pain only relieved at night by morphin; and every day, or at least every few days, he vomited a copious amount of bile-stained material. On September 21st an *x*-ray study of his gastro-intestinal tract showed that the stomach emptied rapidly through the gastro-enterostomy opening and that it was empty at the six-hour examination. There was marked stasis in the terminal ileum at the end of six hours. None of the barium meal seemed to pass by the pylorus. The small intestine just below the anastomosis, whether proximal or distal, could not be determined, showing pouching and dilatation. No vicious circle could be seen, Dr. Bromer said, but he thought that the possibility of a gastrojejunal ulcer must be borne in mind. The patient begged me every day to operate on him, and I kept him in the ward long enough before operation to be sure that he really was suffering and that he was not merely a neurasthenic; and though I was inclined to believe that the trouble was due to the existence of a vicious circle in his former gastrojejunostomy I could not be certain that the gastrojejunal ulcer, which our roentgenologist suggested, was not present.

On September 29th (fifteen days after admission) I operated on him, with many misgivings, recollecting that the last surgeon after working for two hours had not succeeded in finding anything except adhesions. It was difficult to choose a new place for the fifth incision in his upper abdomen, but I selected the region just to the right of the midline, leaving two scars on the left, and two on the right, making the incision 30 cm. long and opening the parietal peritoneum very high up. I found the liver and the prepyloric portion of the stomach and the gall-bladder all adherent to the parietal peritoneum and to each other. These were separated down to the foramen of Winslow, which was found patulous. The gall-bladder appeared normal and except at its fundus was free from adhesions. This region was temporarily packed off and the parietal peritoneum was opened below the area of adhesions just above the umbilicus, and a pack was introduced to keep the small intestine from prolapsing. The adhesions of the omentum and the transverse colon and stomach and small intestines were then dissected free from one end of the incision to the other on the left side of my incision away over beyond the most left lateral incision, thus completely freeing that side of the parietal peritoneum. Finally, the jejunum was found densely adherent to the under surface of the mesocolon and was dissected free up to the anastomosis with the stomach, which was patulous, and where no ulcer could be felt. The afferent loop (duodenum) was obstructed because the surgeon who had made the gastrojejunal anastomosis ("no-loop" method) had twisted the jejunum on itself so that the anastomotic opening lay more or less in the transverse axis of the patient's body. I will speak further of this fault in technic later. A sponge was passed beneath the anastomosis and one Payr clamp placed on the stomach and one on the jejunal loop parallel to the anastomosis, and the anastomosis was divided between these clamps with the actual cautery. The stomach was closed with considerable difficulty owing to its high position, and the transverse mesocolon was closed beneath the stomach; and then the area of the jejunum in which the anastomosis was situated was excised and an end-to-end anastomosis done. To have sutured the opening into the jejunum would have caused too much stenosis. When after this procedure I made a revision of the wound before closing the abdominal wall I was upset to find that the pylorus seemed thickened, and it was almost doubtful whether it was sufficiently patulous, especially in view of the report of the roentgenologist that no barium had ever been seen to pass by the pylorus. However, as the operation had already lasted more than two hours, I did not deem it wise to prolong it, either to do a pylorectomy or even to remove the appendix.

On the fourth day after operation the patient vomited four times, and on the fifth day five times, but as he still vomited bile I was satisfied that the pylorus was actually patulous, and this was proved by an *x*-ray study made on the fifth day after operation, which showed the barium passing freely by the pylorus. The last time that he vomited in the hospital was October 13th, two weeks after operation, when he vomited five times, very profusely. Before leaving the hospital an *x*-ray examination showed that the stomach was very small and lay high up in the epigastrium, that it emptied rather rapidly, that there was no six-hour retention, that there was a filling defect at the prepylorus probably due to adhesions, but nothing to indicate a definitely localized ulcer. On November 3d he was discharged free from symptoms, having been walking around the ward in perfectly good health for more than two weeks. When seen again six weeks later his weight had returned to 145 pounds, only 2 pounds less than normal, and he had vomited only twice since leaving the hospital.[1]

Now such a patient as this, who has suffered many things at the hands of many surgeons, may be thankful to have his anatomy restored as nearly to normal as possible. The only criticism that I think I could make in addition to condemning the unnecessary operations which have been done upon him is that he has never had his appendix removed, and perhaps I should have done that myself, but he had enough other trouble when he was under my care to make me willing to postpone that for another occasion.

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[1] He was again under observation in the ward for about a week at Christmas time. His nausea and occasional vomiting was rapidly and entirely relieved by attention to diet. He slept soundly all night after a hypodermic injection of sterile water, on the few occasions when he complained of sleeplessness and pain.

Case II. Duodenal Ulcer Unrelieved by Cholecystostomy done for Upper Abdominal Symptoms.—Speaking of doing unnecessary operations, I have had the following experience myself: In 1914 I operated on a man, George G., then forty-four years of age, who had had inflammation of the stomach, as he called it, when sixteen years of age, and this continued for seven months. He said that he meant by inflammation of the stomach severe pain in the stomach and vomiting. He was perfectly healthy from that time up to the age of twenty-five years, but from the age of twenty-five years up to his present illness, when he was forty-four years of age, he had had periodic attacks of vomiting and severe colicky pains in the right upper abdomen. These attacks used to last for several weeks at a time. He would first regurgitate his food with nausea, followed by severe pain, agonizing and colicky in the upper abdomen, and relieved only by medicines. Between these attacks he felt very well. The attack for which he came under my care in 1914 had begun three weeks previously with similar symptoms. These symptoms lasted up to the night before admission, when he was suddenly stricken with severe colicky pain in the right abdomen which lasted four hours. This pain radiated to the opposite side and to the left shoulder, but never to the right shoulder or downward. Since admission (August 11, 1914) there had been less acute pain and only soreness in the back and the stomach. There was no history of any urinary trouble. His normal weight was 165 pounds. Examination was negative except for tenderness over the gall-bladder, especially at the end of deep inspiration, and slight tenderness in the right costovertebral angle.

Operation on August 14, 1914 showed the gall-bladder adherent to the hepatic flexure of the colon and the liver adherent to the duodenum. The pylorus was lightly adherent, but it admitted the finger easily, and there were no ulcers or cicatrices palpable. As no stones were found in the gall-bladder or ducts, the gall-bladder was drained. Culture of the bile was negative. He went home about four weeks after operation, saying he felt very well; but in September, 1920, about six years later, he came back complaining of much the same symptoms, although the present attack had begun only about three months previously. He vomited one or two hours after his meals after having epigastric pain for some time. Nearly every night he vomited about six hours after his evening meal. He felt better when the stomach was empty. He had never been jaundiced and said that he had lost 20 pounds in the last three months. He said he was not improved by the gall-bladder operation six years previously, but had been worse than usual for the last few months. *x*-Ray examination by Dr. Bromer showed the stomach in fair position, no retention, no filling defects suggestive of ulcer; tendency to pylorospasm, probably reflex. Slight stasis in the terminal ileum at the end of six hours, which might suggest adhesions, but there were no points of tenderness which are usually found where there are adhesions. The twenty-four-hour examination was negative. So under the diagnosis of pylorospasm I operated on this man again September 14, 1920. I found the omentum densely adherent to the former scar, and after identifying the pylorus thought I could palpate a suspicious mass in the duodenum. This appeared to be in

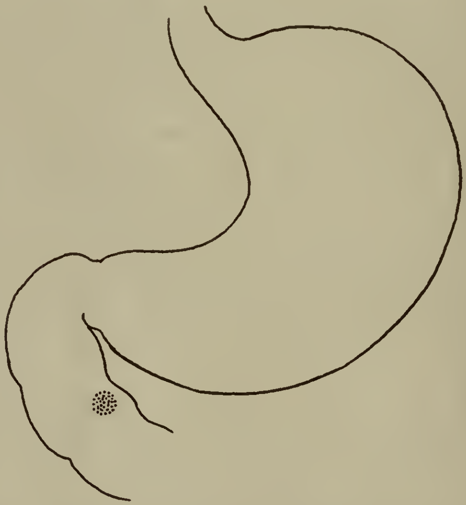

Fig. 3.—Chronic ulcer of the duodenum on the posterior wall: a site where its existence is often overlooked.

the descending part of the duodenum on the posterior median wall. After separating the duodenum from the gall-bladder, to which it was densely adherent, and mobilizing the duodenum, this mass was clearly evident—a chronic ulcer of the duodenum (Fig. 3); and I suspected very strongly that it had been there at the time of my operation six years before, but that I had not made a sufficient search to locate it. A posterior gastrojejunostomy was done, as it seemed impossible to excise an ulcer in this situation. The man recovered uneventfully and had no recurrence of symptoms. He reports (January 6, 1923) that his health is excellent, and that he can eat anything, specifying "beans and cabbage." He works at night as a fireman's helper.

Case III. Duodenal Ulcer Not Discovered During an Exploratory Operation Nearly Four Years Previously.—Not long after the operation which I have just described there came under my care another patient, Harrison R., a man twenty-six years of age, whose chief complaint was nausea and vomiting. He had been operated upon in a Naval Hospital in July, 1917 for acute appendicitis. About five weeks after this appendicitis operation he says he had fecal vomiting and then had a second operation done, which he thinks was an intestinal resection. In April, 1919 he had an exploratory upper abdominal operation done, but the surgeon found nothing but adhesions, and closed the wound. He says that the symptoms present then have persisted, and he complains now, besides his nausea and vomiting, of pain about an hour after eating; and he says this pain is relieved by soda, but not by eating food. He says this is not the same kind of pain as he had before the operation for appendicitis. His normal weight was 172 pounds; when he came under my care it was 145 pounds. He looked rather anemic and undernourished.

x-Ray examination by Dr. Bromer showed the pylorus lying well toward the right, the duodenal cap dilated, lying in close proximity to the hepatic flexure and showing quite constant distortion and deformity. There was a tendency to hyperperistalsis and at the end of six hours there was retention of one-fourth of the barium meal in the stomach. The roentgenologist's diagnosis was a lesion about the pylorus in the first part of the duodenum pinning down the pylorus and cap.

January 28, 1921 I operated on him, and found just as I had done in Case II—a callous ulcer in the descending portion of the duodenum against the pancreas (Fig. 3). There were innumerable adhesions. A posterior gastrojejunostomy was done, from which the patient recovered uneventfully, and when seen fourteen months later he had gained 30 pounds in weight, and had vomited only once since the operation, and then only after a heavy meal of baked beans. Two years after operation he reported he was "feeling well and gaining weight. All right at times, but then at others he is uncomfortable when lying in bed. Can eat anything now."

x-Ray examination at this time showed no six-hour retention, normal peristalsis, a functioning gastro-enterostomy opening, but still the failure to fill of the pyloric cap.

These 2 patients presented identical lesions; both had been operated on previously without the true cause of their trouble having been discovered; and, as I say, it is almost as bad to do that as to do an operation on a patient when no operation whatever is indicated.

Case IV. Carcinomatous Ulcer on Lesser Curvature of Stomach; Excision.—I want also to present today a man forty-five years of age, an iron molder by trade, who was sent into the hospital by Dr. H. G. Godfrey September 29, 1921, his chief complaint being pain in the stomach and vomiting. He had been operated on twenty-two years previously at the German Hospital, of Philadelphia, now the Lankenau Hospital, for acute appendicitis with abscess. Since then he had been in good health until five years previously, when he began to have sour eructations, belching, and much gas. He also had complained at times of acute pain in the stomach after eating. And then his vomiting became more frequent. As long ago as December, 1920 he vomited some blood after a severe attack of pain and unconsciousness. The amount of blood lost is not known. Evidently his unconsciousness was caused by hemorrhage into the stomach causing faintness, and then afterward he vomited as he came to. He had vomited blood only once since, and thought that since these hemorrhages he had had less pain and vomiting, but the belching of gas continued. One week before admission he vomited a cupful of coffee-grounds material and the day before admission he vomited about a quart of blood five hours after eating a meal of soft eggs, bread, and coffee. He got very weak, but did not lose consciousness this time. He had been constipated for about five years and had had to take purges constantly. He never passed fresh blood by the bowel, but one year ago passed some black stools. He said he had lost about 30 pounds in weight in the last ten months. His weight on admission was 104 pounds.

Except for a rather pale, anemic appearance, physical examination was negative, but there was a small reducible incisional hernia at the lower end of the scar of the appendix operation.

The red blood-cells numbered 1,920,000, the hemoglobin was 38 per cent., and the white blood-cells 9600, of which 56 per cent. were "polys." and 39 per cent. lymphocytes.

The blood Wassermann was negative, as was his urine; his phthalein output, a few days after admission, was 20 per cent. for the first hour and 10 per cent. for the second hour, or a total of 30 per cent. for the two hours.

We kept him on liquid diet at first, but as he grew better he took soft diet; and after three weeks, although he was still in bed and had considerably improved, his red blood-cells still numbered only 2,750,000 and his hemoglobin only 54 per cent. On that day he was transfused by the citrate method by Drs. Bishop and Holloway, two of our interns, 500 c. c. of blood being taken from his brother, who as well as the patient was of the Type IV of Moss's classification. After the transfusion the red blood-cells numbered 2,890,000 and his hemoglobin was 59 per cent., not a very striking change. We then thought him well enough to have *x*-ray studies made of his stomach; and accordingly, on October 21st, the following report was received from Dr. Bromer, our roentgenologist: There was a crater on the lesser curvature, with a very definite outline (Fig. 4); there was interruption of peristalsis at this site, but there was no six-hour retention. The roentgenologist's diagnosis was an ulcer on the lesser curvature. This seemed a reasonable diagnosis for the surgeon to make, also, in view of the patient's history and the *x*-ray findings. The vomiting of bright red blood, and especially the occurrence of massive hemorrhage, are characteristics of ulcer rather than of carcinoma; and the single report of vomitus consisting of coffee-grounds material was not sufficient of itself to justify a diagnosis of carcinoma; while the *x*-ray picture, as you see, is quite typical of a callous ulcer.

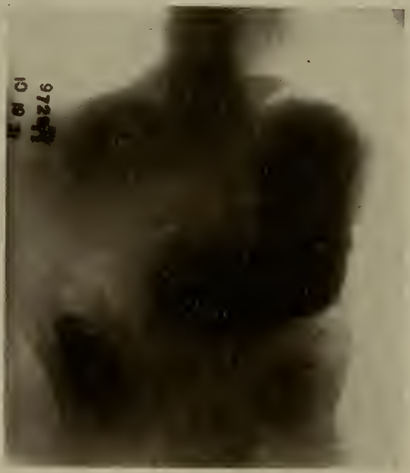

Fig. 4.—Case IV. *x*-Ray of stomach showing callous ulcer on lesser curvature. Excised. Microscopic report: Scirrhous carcinoma.

Operation was done October 25, 1921 (during the meeting of the Clinical Congress of Surgeons) through a left epigastric paramedian incision 18 cm. long; the pylorus was normal, but on the lesser curvature, about 5 cm. from the cardia and just where the crater shows in the skiagraph, there was a callous ulcer. The pancreas was lightly adherent to this region and there was a local hardness in the pancreas in this neighborhood. Now it is well recognized by surgeons that a gastrojejunostomy alone is less suitable for ulcers in this situation than for any others, and though almost all surgeons agree that it is proper to excise an ulcer of this type wherever it is situated if it is possible to do so, it is almost imperative to excise an ulcer situated such as this one is high on the lesser curvature. Very few ulcers in this situation will heal after the performance of a gastrojejunostomy alone. Accordingly, I detached the gastrohepatic omentum from the region of the ulcer and placed a pack in the lesser peritoneal cavity behind the stomach. I next caught the margins of the ulcer in curved hemostats and then excised it with the cautery. The wound in the stomach was closed with continuous through-and-through over-hand sutures of chromic catgut, and this row again was inverted with a seroserous suture of chromic gut. Mr. Moynihan states that he employs No. 000,000 (6 zero) chromic catgut for all of his intestinal work, but I suspect that the English scale must be different from ours in regard to catgut as well as in regard to the caliber of urethral instruments, because no surgical supply house and no surgeon of whom I have inquired had ever heard in this country of catgut finer than triple zero; and I am satisfied to use either double zero or triple zero for these sutures. In combination with other surgeons I have abandoned the use of linen sutures even for the seroserous stitches in gastro-intestinal work, and have had no reason to wish to return to the linen. After closure of the opening in the stomach the latter was somewhat deformed, so this excision of the ulcer was supplemented by a posterior gastrojejunostomy done in the usual way. Perhaps I ought to be more explicit upon this point, for while I believe it ought to be the usual way, I suspect that it is not the usual way in which the operation is done. The jejunum normally hangs more or less vertically from its origin when the patient is upright; it will swing either to the left or to the right according to the position of the patient. It was long ago (in 1901) pointed out by Petersen (an assistant of Czerny) that the most sensible way in which to anastomose the jejunum to the stomach was to turn it neither toward the left nor toward the right, but to keep it as nearly as might be in the longitudinal axis of the patient's body, so that when the viscera are replaced the proximal end of the jejunum corresponds to the lesser curvature of the stomach and the distal end of the jejunal opening with the greater curvature. I can see no occasion for turning the jejunum either toward the right or toward the left. The transverse mesocolon in this case was adherent to the posterior wall of the stomach except near the lesser curvature, but wherever it is not adherent it is sutured to the stomach so as to prevent prolapse of the small intestine through the opening, and also so as to prevent the opening in the mesocolon from becoming adherent around the jejunum below the anastomosis, since in that position it may cause constriction or angulation of the jejunum and so interfere with the proper functioning of the anastomosis. There is also no occasion to attach the jejunum to the stomach proximal and distal to the anastomosis when the opening in the stomach is made as I have advised, because there is

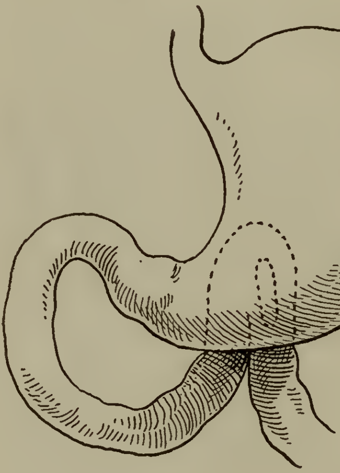

Fig. 5.—Proper direction of opening in posterior gastric wall for a gastro-jejunal anastomosis. The jejunum hangs as before the operation, twisted neither to the right nor to the left.

no tendency for the jejunum to be kinked. When the viscera are returned to their normal position the jejunum lies as before the operation (Fig. 5).

This patient recovered without a single unfavorable symptom except for a slight bronchitis on the third and fourth days after operation. The laboratory report, unfortunately, showed that the ulcer was a scirrhous carcinoma and not, as had been thought before operation, a simple ulcer. His symptoms were completely relieved, however, and he left the hospital three weeks after operation. At the present time (fifteen months after operation) he is in fair general health, with no abdominal symptoms of any kind, having gained 23 pounds (10.36 kg.) in weight since leaving the hospital. Dr. Godfrey tells me, however, that he gives evidence of early tuberculous changes in his lungs.

Case V. Perforation of a Gastric Ulcer Followed by Carcinoma.—A young woman, Mrs. Ada J., aged twenty-eight, came under my care first in September, 1919, complaining of dysmenorrhea, which I thought was caused by anteflexion of the uterus and a stenosis of the cervix. This was treated by a Dudley operation on the cervix. The abdomen was then opened and several cysts of the ovaries excised and sutured, the appendix was removed, and a very redundant and mobile cecum lying in the pelvis was replaced in the right iliac fossa and fixed to the parietal peritoneum by sutures.[1] She came back to see me at the hospital about four months later, feeling fairly well, but complaining now that six weeks previously she had developed a little pain in the left side between the crest of the ilium and the margin of the ribs, and saying that she had a "drawing sensation" over the lower left ribs. I examined her as I thought thoroughly at about 1 P. M. and could find nothing wrong with her. Her abdomen was soft and not tender. Her chest was negative and pressure over her left hypochondriac region, where she complained of the drawing sensation, caused her no discomfort. So she went home, but scarcely had she arrived there when she got a sudden severe pain, coming on without any notice, at first only in the abdomen, but in a few minutes the pain spread all over her body. She vomited several times and felt very weak and sick. She was seen at once by her physician, Dr. Godfrey, who sent her back to the hospital with the diagnosis of perforated gastric ulcer. When I operated upon her about six hours after the perforation occurred I found a perforation about 1 cm. in diameter, with indurated margins, on the anterior wall near the lesser curvature and about 4 cm. from the cardia. This was closed and a posterior gastrojejunostomy was done. She recovered uneventfully.

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[1] The influence of a mobile cecum in producing upper abdominal lesions has been much insisted upon by Waugh, in an able paper in the British Journal of Surgery (1920, vii, 343).

x-Ray examination by Dr. Bromer in July, 1920, six months after closure of the perforation, showed an incisura on the greater curvature of the stomach with a niche on the lesser curvature which was constant throughout the entire fluoroscopic examination. No movement of the barium could be seen through the gastro-enterostomy opening. Dr. Bromer said that if the ulcer had been excised at the previous operation this was undoubtedly a recurrence. If it had not been excised it was a persistence of the ulcer unhealed. She felt fairly well until November, 1920, when she vomited some blood, and then I urged her physician and he urged her to return to the hospital and have the ulcer excised. But during a period of nine months, in 1921, she was entirely free of all gastric symptoms. Just before Christmas, 1921, stomach symptoms returned, and continued up until her readmission at the end of March, 1922. She had taken to her bed about four weeks before this time and had been jaundiced for the last two weeks. She was extremely jaundiced and very emaciated on admission; her abdomen was greatly distended, tense, and tympanitic, except in the dependent portions and in the left epigastrium, where there was a mass which was very tender. I thought possibly she had a chronic or subacute perforation of the ulcer, with an abscess around the stomach, and on March 28, 1922 I operated on her again, finding free bile-stained and bloody fluid in the peritoneal cavity, about 1000 c.c. being evacuated. There was a fixed mass in the gastrohepatic omentum extending from the lesser curvature, evidently a carcinoma. The stomach, pylorus, and duodenum were adherent to the old scar, which was to the right of the present incision. The old gastro-enterostomy was exposed; it was not thickened and appeared to be normal. Owing to the extent of the adhesions and the hopeless nature of the condition the liver was not exposed. The patient died of exhaustion about two weeks after this operation. Autopsy showed at the lesser curvature at the cardia a carcinoma adherent to the liver, numerous nodules of secondary carcinoma in both lobes of the liver, the diaphragm adherent to the left lobe of the liver and invaded by carcinoma, the gall-bladder greatly distended and tense, the common duct compressed by a retroperitoneal mass of carcinoma, or by direct invasion; and there was bile-stained fluid in the peritoneal cavity.

This case is of interest because of the premonitory symptoms of perforation of the stomach which she presented; and had we known of the existence of an ulcer of the stomach, such symptoms should have put us on our guard against a threatening perforation. It is also of interest to speculate whether the primary lesion in the stomach was carcinomatous, or whether the carcinoma developed in the bed of the old ulcer. Might it not have been better to have excised the ulcer at the time of the perforation?

Case VI. Result of Partial Gastrectomy for Carcinoma.—I thought it would be of interest to you, in connection with the patients I have just presented, to have come back today a man (Mr. Ernest M.) on whom I operated more than two years ago for a rather extensive carcinoma of the stomach. He was fifty-five years old and until eighteen months before admission to the hospital on September 28, 1920 he had been in good health; but then he began to get indigestion, sour stomach after eating, belching up much gas and acid tasting material several hours after eating. Medicine had done him no good. Nine months before admission he began to vomit every time he ate a full meal, and until he came into the care of Dr. Freas, who referred him to me, he was in very miserable condition. Dr. Freas wisely restricted his diet to liquids and found that he could retain milk very well. He had no appetite at all, was very constipated, had lost 50 pounds in weight, and was naturally very nervous and worried about himself. He had vomited some coffee-grounds material at times.

This may be considered a typical history of carcinoma of the stomach: a patient past middle life develops, rather suddenly, stomach symptoms which persist in spite of treatment, and which continue to grow worse without any remissions or free intervals. Appetite is lost; weight is lost; while the coffee-grounds vomitus and the roentgenologic examination serve merely to confirm a diagnosis which should have been settled by exploratory operation, if necessary, before such late symptoms appear.

The *x*-ray showed a lesion involving the pylorus and the prepyloric part of the stomach, and Dr. Bromer added that at the pylorus there was an accessory pocket which was constant, and which he thought was probably the site of the original ulcer, the rest of the filling defect being due to the superimposed carcinomatous mass. From *x*-ray examination it appeared to be a suitable case for resection.

The patient's red blood-cells numbered 4,120,000 and his hemoglobin was 56 per cent. His blood Wassermann was negative, as was his urine.

At the operation (October 1, 1920) I found no metastases palpable in the liver; in the prepyloric region of the stomach there was a callous ulcer adherent to the head of the pancreas and extending from the greater to the lesser curvature and causing obstruction. Except for the posterior adhesions the tumor was freely movable, the size of a medium-sized apple, and caused an hour-glass contracture of the stomach. A partial gastrectomy was done, the open end of the stomach being implanted into the antimesentric border of the jejunum, according to Polya's method. The patient recovered without unfavorable symptoms and went home three weeks after operation. Two months after his discharge he was able to return to work and has remained in good health since. A curious habit that he acquired after operation was a fondness for sauer kraut. He ate 2 quarts of this every day for a long period of time, making four meals out of it, with bread and sometimes with potatoes.

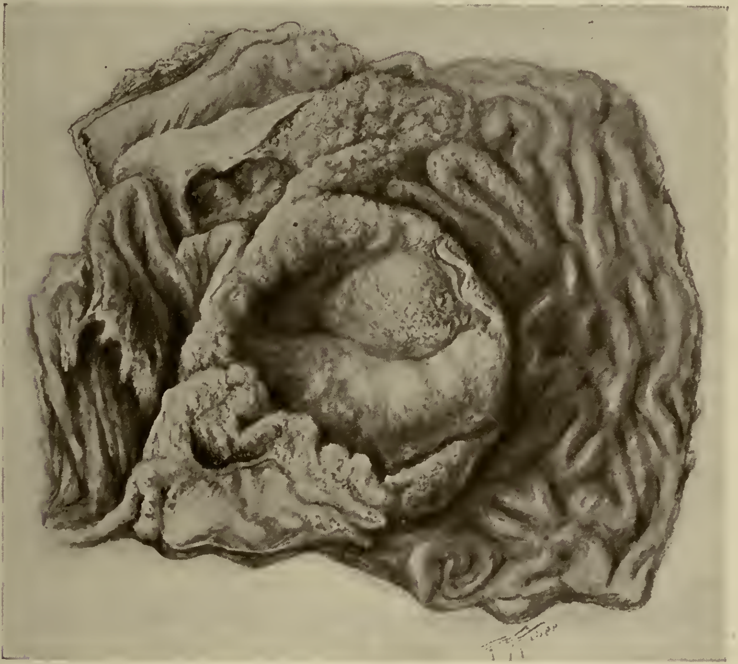

Fig. 6.—Specimen of carcinoma of stomach removed by partial gastrectomy—"colloid carcinoma." Specimen has been opened along lesser curvature and anterior wall of stomach turned down; the pylorus was obstructed and the duodenum (at left) was sectioned 2.5 cm. beyond growth; the section at cardiac end was 4 cm. distant from growth. A callous ulcer at the lesser curvature, with deep crater, was densely adherent to the pancreas (chronic perforation); it has been bisected by incision along lesser curvature, extending up both anterior and posterior walls to the lesser curvature. (Case VI.)

He never has had noteworthy gastric or intestinal symptoms since operation and is now in very good health.[1]

Figure 6 shows the portion of the stomach removed. You will see it has been opened along the lesser curvature. Dr. C. Y.

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[1] At present, February, 1923, twenty-eight months after operation, he continues well. Weight 150 pounds.

White's report of the histologic examination showed it was a colloid carcinoma. On the lesser curvature, also, is to be found on the posterior wall a chronic perforation of the stomach which was adherent to the pancreas, and contiguous to this is the carcinomatous ulcer itself, which is about 8 cm. in diameter and occupies the entire remaining lumen of the stomach.

Case VII. Subtotal Gastrectomy for Carcinoma: Death.—Patients do not always recover after operation, unfortunately, because one is tempted to do resection wherever possible, and sometimes one's judgment as to the ability of the patients to withstand resection is in error. Thus, as Dr. Mayo has well pointed out, the higher the percentage of radical operations that are done by a surgeon, the higher will his immediate mortality be; whereas, if he were to content himself with doing palliative operations in borderline cases his immediate mortality might be low, but his ultimate cures would be very few.[1] In my own experience, for instance, I have found that up to the present (January 1, 1923) I have been able to do a radical operation in 21 per cent. of cases of carcinoma of the stomach, with an immediate mortality of 25 per cent., which, as I have said, is high. I have done a palliative operation, gastrojejunostomy (or in one case of hour-glass stomach from carcinoma, a gastrogastrostomy), in 42 per cent. of the cases, with an immediate mortality of 50 per cent., the remaining patients being really relieved by the palliative operation. (This does not include cases of carcinoma of the esophagus or cardiac orifice of the stomach.) Every patient dying in the hospital, even if only several weeks after operation, is counted as an operative death. The longest duration of life after palliative operation was about one year. In 36 per cent. of my gastric carcinoma cases I have been unable to do anything after opening the abdomen, and have merely closed the wound again.

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[1] Besides the patient (Case VI) whose history I have just narrated, and who is fast approaching the period of a "three-year cure," I can boast of only one patient who has actually passed the three-year period after partial gastrectomy for carcinoma; he is now well on into his fourth year in good health. Scudder, in 1921, traced 103 patients who had been operated on at the Massachusetts General Hospital for carcinoma of the stomach, and found that not a single one had survived for three years.

OPERATIONS FOR CARCINOMA OF THE STOMACH

	Operative mortality.
Exploration only, in 36 per cent	43 per cent.
Palliative operation, in 42 per cent	50 "
Radical operation, in 21 per cent	25 "

The patient, an illustration of whose specimen I show you now (Fig. 7), was a woman sixty-five years of age, and I operated on her September 27, 1921. Her chief complaint on admission was vomiting, nausea, and pain in the stomach. Except for a hysterectomy for fibroids twenty-five years previously she had never been ill. Up until five or six months before operation she was not conscious of her stomach, but about this time she was kicked in the abdomen by a pet dog which jumped into her lap. This probably called her attention to her stomach, for she now found that she developed pain when she ate, that food nausated her and caused vomiting. The vomiting had gradually become worse and often she had vomited blood. Lately she had been unable to retain even fluids. The vomitus was frequently like coffee-grounds in appearance. For a long time she had had some edema of the feet, headache, vertigo, and nocturia. She had no hemorrhoids, however, and never passed blood by the bowels. She had had no cough, dyspnea, or palpitation of the heart. She had been very constipated and at the time of admission her bowels had not moved for a period of two weeks. She had lost 34 pounds in weight in the preceding six months. Her red blood-cells numbered 4,150,000 and her hemoglobin was 65 per cent.

On admission she looked more ill than there seemed to be any reason for. Her skin, mouth, and lips were dried out, and in the epigastrium to the right of the midline there was an indistinct mass, not tender and apparently not movable. For continual vomiting her stomach was washed, the contents of the washing being dark blood and bile, the presence of the bile indicating that she had not complete pyloric stenosis. An enema was effectual, producing three good bowel movements.

Four days after admission, fluids having been forced into her, it seemed to me that she was in fit condition for operation; and I really did not expect to be able to do anything radical, planning to do only a gastrojejunostomy, but on opening the abdomen I could find no metastases in the liver, and the pylorus appeared normal; but on the lesser curvature of the stomach, extending almost to the greater curvature and from 4 cm. proximal to the pylorus almost to the cardia, was a tumor mass which was freely movable. It extended so far toward the left on the greater curvature of the stomach that it seemed to me

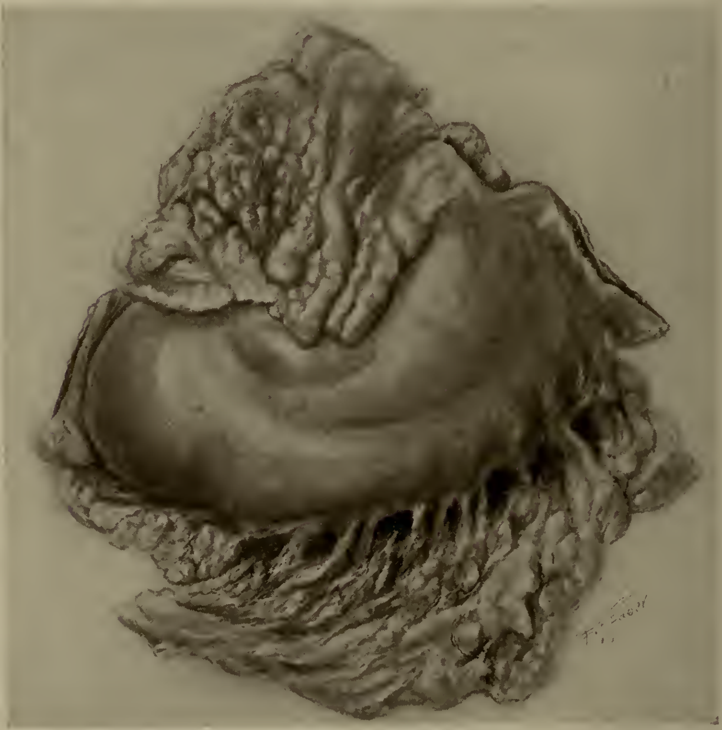

Fig. 7.—Portion of stomach excised (for carcinoma) with gastrohepatic and gastrocolic omenta attached. (Case VII.)

it would have been very nearly as troublesome to do a gastrojejunostomy as to do a gastrectomy, and, accordingly, I selected the latter operation. The stump of the stomach was implanted into the side of the jejunum, and though the patient was in very poor condition at the end of the operation, the next day she was somewhat relieved after gastric lavage, but the third day after operation she died of asthenia. I opened up the wound and found no cause in the abdominal cavity for her death. About one-fourth of the stomach remained; all the sutures had held firmly; and I removed the specimen for preservation. I found now a secondary growth on the under surface of the right lobe of the liver far posteriorly; so that even had she survived the radical operation it is not likely she would have been free

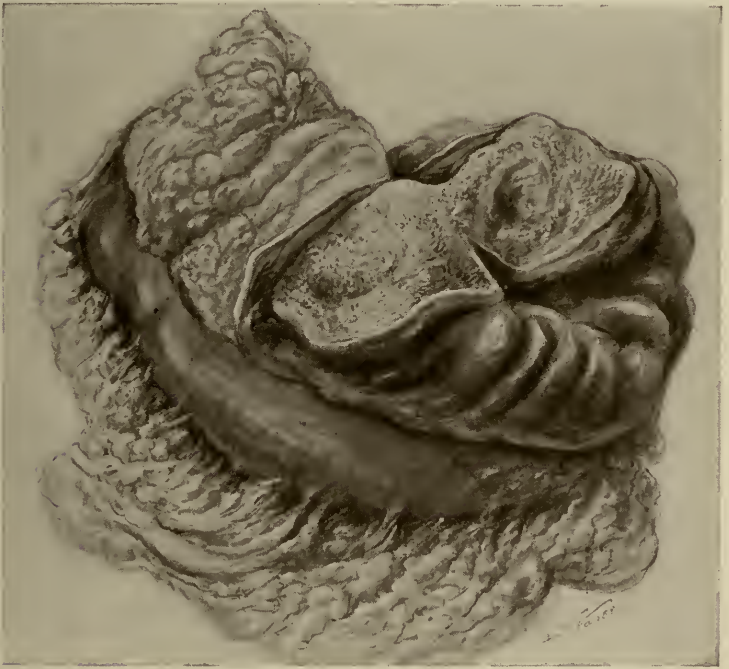

Fig. 8.—Portion of stomach excised for carcinoma opened partly along lesser curvature, exposing large ulcerated surface of the tumor extending on anterior and posterior walls of stomach. (Case VII.)

of recurrence for a very long time. The operative specimen as you see (Fig. 8) shows an ulcer on the lesser curvature of the stomach, nearly round, with indurated and raised walls. The pyloric section is 5 cm. from the margin of the ulcer, but the cardiac section, although it passed nearly to the esophagus, is not more than 2 cm. away from the margin of the ulcer. You know it is much more important to get a large free margin on the cardiac side of the carcinoma than on the duodenal side because the cancer cells, as has been proved microscopically, invariably tend to grow toward the cardia rather than toward the duodenum. The specimen removed postmortem (Fig. 9)

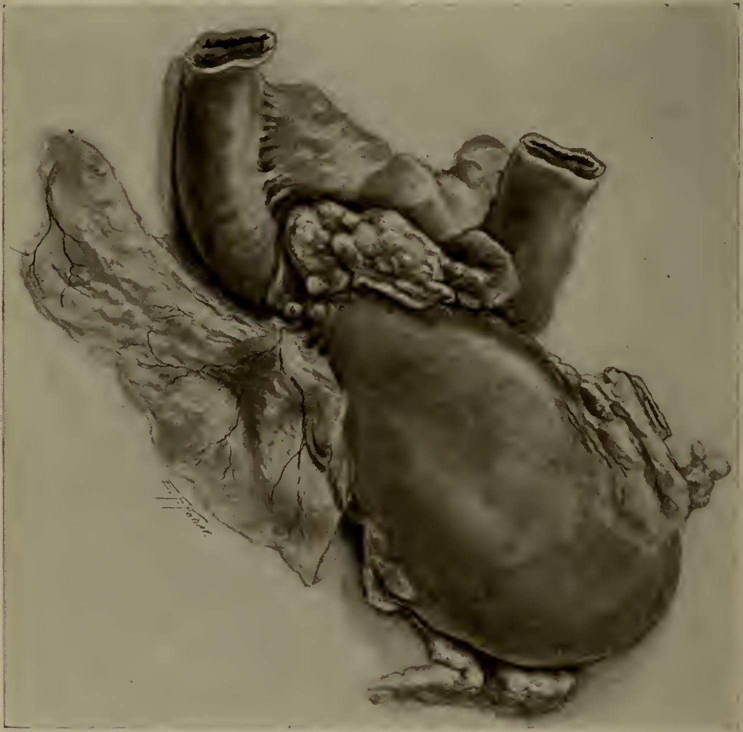

Fig. 9.—Specimen removed postmortem, including cardiac end of stomach, with jejumun anastomosed to its opened end. Note portion of great omentum hanging from greater curvature, and piece of transverse mesocolon sutured to stomach above jejunal loop. (Case VII.)

shows the stump of the stomach implanted into the antimesenteric border of the first coil of the jejunum, which was brought up through the transverse mesocolon, according to Polya's method. Though we currently speak of this anastomosis as Polya's method, because it was popularized by Polya in 1911, and brought prominently to the attention of surgeons in this country by Mayo in 1914, yet I think it is interesting to recall that as early as 1898 Mikulicz stated that he preferred to all others this method of terminating the operation of gastrectomy.

In conclusion, I would have you bear in mind (1) that it is important not to do such an operation as gastrojejunostomy unless there is a clear indication for it (Case I); (2) to make thorough enough search to make sure that the true lesion is not overlooked (Cases II and III); (3) to excise chronic gastric (and duodenal) ulcers whenever accessible, because some of them are carcinomatous (Cases IV and V); and (4) that if we are to hope to secure permanent cures in cases of frank gastric carcinoma (Case VI) it is necessary to attempt radical operation in borderline cases even if to do so brings us a high primary mortality (Case VII).

CLINIC OF DR. T. TURNER THOMAS

NORTHEASTERN AND PHILADELPHIA GENERAL HOSPITALS

OPERATION ON STRANGULATED INGUINAL HERNIA IN THE PRESENCE OF AN OVERLYING SUPPURATING BUBO AND SEVERE INFLAMMATION OF THE SURROUNDING SKIN AND SUBCUTANEOUS TISSUE, WITH RECOVERY

THIS man is seventy years old, a clerk. He is slender, but has always enjoyed good health and has good color and nutrition for his age. When a boy he developed a small inguinal hernia on the right side which never became larger than a hickory nut. About thirty-five years ago he developed a left inguinal hernia and soon afterward began to wear a truss for both herniæ. For a number of years there has been no visible evidence of a right hernia. He never wore the truss at night, when the left hernia would come down occasionally, but it could always be reduced easily until July 7, 1922. About 10.30 P. M. on that day, while at his bungalow in the country, it began to cause pain and could not be reduced. About 10.30 on the following morning a physician came in, and after about forty-five minutes' manipulation accomplished reduction. He tightened the truss posteriorly by pulling the strap up one hole at the buckle to retain the hernia more securely, and advised the patient to wear the truss continuously. Within a week there was chafing of the skin at the site of the hernial pad and the patient on his return to his home in the city feared to remove the truss. Gradually an inflamed mass developed, with one or more softened lymph-nodes within it. On August 31st last his physician, Dr. William H. Annesley, was called because the pressure-pain prevented the wearing of the truss any longer. The patient was kept in bed to favor retention of the hernia without the truss. On the night of

September 1st much pain developed in the region of the hernia and tended to diffuse itself throughout the abdomen, nausea and vomiting also setting in. I saw the patient first about noon on September 2d. The pain was said to have moderated, but there was slight distention, tenderness, and rigidity of the abdomen. There was a well-developed, diffuse, suppurating bubo just external to the external inguinal ring, and beyond this area a number of boils or pimple-like infected skin glands, indicating a tendency of the infection to spread about. The severe pain of the night before and the persisting nausea suggested strangulation of the hernia. Palpation of the external ring by invagination of the scrotum disclosed a hernial protrusion about the size of a hen's egg, which could not be reduced and was painful on pressure, in addition to the general pain in this region. Operation was advised notwithstanding the overlying suppurative infection, because an unrelieved strangulation was a greater risk than that of peritonitis from operation through such an infected tissue.

The ambulance was summoned and the patient transported to the Northeastern Hospital and the operation begun at about 2 P. M. After shaving the skin with the patient under ether, the region above the infected area was cleansed first with ether then swabbed with tincture of iodin, and this washed off with alcohol. A sterile towel was then made to cover the infected skin and its upper margin clamped to the skin about an inch above the highest infected pimple, or boil, and this margin of the towel directed about parallel with Poupart's ligament. After draping the patient with sterile sheets and towels in the usual manner, an incision about 6 inches long was made in a line with the fibers of the external oblique about 3 inches above Poupart's ligament (See scar in Fig. 10). The wound was immediately further protected from the surrounding infected skin by clamping sterile towels to the wound margins above and below. After cutting through the external oblique, the lower margin of flap was separated from the underlying internal oblique and retracted strongly downward. This retraction was made more easy by adding a vertical extension of this incision downward in front of the rectus muscle. The internal oblique and transversalis muscles and the peritoneum were divided just above the hernial mass and the mouth of the sac exposed from the inside. It was at about the usual site of the internal ring, and the deep epigastric vessels were found immediately to its inner side. These were divided between ligatures.

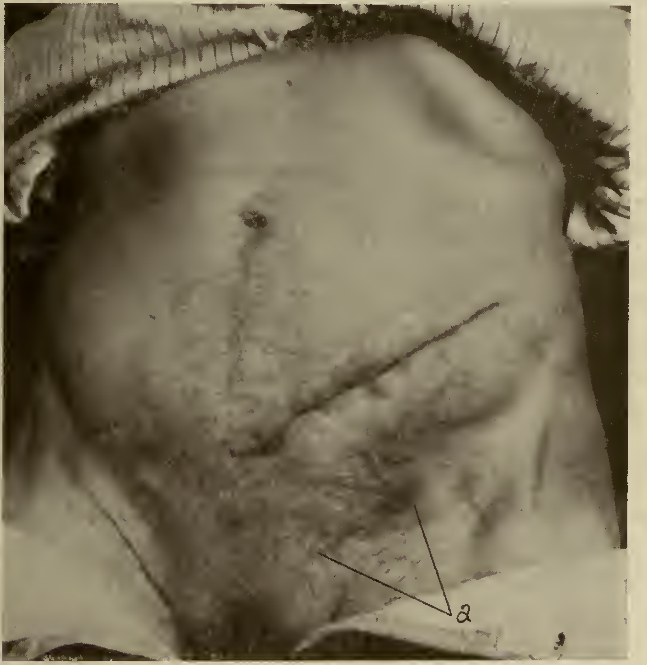

Fig. 10.—Hernia incision scar about 3 inches above Poupart's ligament: *a*, Scar from healing of suppurating bubo. Darkened area below former and above and external to latter scar about corresponds to the area infiltrated by infection.

The hernial sac was then cut open from the inside on a grooved director, and found to contain a single loop of small intestine, which was withdrawn. It was dark in color, especially at its free end, which was black. Later it regained a very good circulation and color. The sac was removed, the peritoneal opening closed by a catgut suture, and the hernial repair completed practically as in the Bassini operation. Before closing the skin wound, because of the badly infected surrounding skin surface, and the consequent danger of peritonitis, the unclosed subcutaneous portion of the wound was swabbed out first with tincture of iodin and then with alcohol. Complete closure of the wound was done, a sterile gauze dressing sealed with collodion applied, and this covered by a thicker gauze dressing and adhesive plaster strips to support the wound. The pus and necrotic tissue of the bubo were then curetted and the cavity swabbed with tincture of iodin and alcohol and dressed.

On 9/11/22 it was noted that the temperature, pulse, and respiration had remained normal since the operation until the day before, when the temperature rose to $100\frac{3}{5}$° F. and the pulse 80. The dressings were removed on this day for the first time since the operation. Pus was exuding from the wound, the margins of which showed none of the local signs of inflammation. The skin sutures were removed and the wound gaped slightly.

On 9/18/22 there was slight necrosis of the wound margins and some in the depth of the wound. There is some reason to suspect that the tincture of iodin was at least partly responsible for this necrosis. The patient was discharged 9/25 to have his wound dressed at home. It was completely healed by 10/26 and he has had no further trouble since. He no longer wears a truss on this side for the hernia.

HIGH APPENDIX AND MODIFIED McBURNEY INCISION FOR ITS REMOVAL

A MAN fifty-five years old has been a railroad clerk since his leg was amputated twenty-five years ago. He is a large man, slightly corpulent, but in good health, being a moderate smoker and previously a user of alcohol in moderation. He was admitted to the Northeastern Hospital October 23, 1922 with severe pain in the right side of the abdomen. Two weeks before he complained of acute abdominal pain which he attributed to indigestion and constipation, and which disappeared in a day or two without medical attention. About 5 A. M. on the day of admission he was again seized with a similar pain severe enough to "double him up." He ate a light breakfast, but vomited soon afterward, this being followed by a weak spell and perspiration. He walked into the hospital at 7.30 A. M. with difficulty and apparently in very severe pain. He exhibited marked tenderness and rigidity on the right side of the abdomen.

Operation on the same day at 1 P. M. through a McBurney incision. On attempting to locate the cecum a vertical portion of large intestine was found at about the usual site of the cecum and ascending colon and its bands traced downward without locating the cecum or appendix. The persistent efforts to locate the appendix by the palpating fingers were unsuccessful. It was then decided that the exposed portion of large bowel was the right limb of a curved transverse colon, but the McBurney incision did not permit one to follow it far up to expose the cecum. The McBurney was enlarged by extending upward from its inner end an incision through the anterior layer of the rectus sheath about 3 or 4 inches, the rectus muscle was then pushed inward, and the posterior layer of the rectus sheath and peritoneum was incised in a similar manner. Retraction of the margins of this wound permitted exposure of the cecum, which was at about the level of the hepatic flexure of the colon. The appendix was seen entirely retroperitoneal, directed outward and downward toward the anterior superior spine of the ileum. At its tip the appendix was covered with peritoneum on its sides, but did not have a mesentery. In the rest of its extent it was covered by peritoneum only on its anterior surface. It was lifted enough to get a hemostat under it, clamped, and freed in the usual manner, when it was removed and the stump invaginated as usual.

The posterior incision in the rectus sheath and peritoneum was sutured by chromic gut, the rectus muscle then being allowed to fall back into its normal situation over this repaired posterior sheath, and the anterior incision in the rectus sheath was sutured in a similar manner, thus reducing the large abdominal incision to the original McBurney, which was then closed in the usual manner. On October 29th it was noted that the course had been uneventful except for some tympanites which disappeared largely with the first bowel movement on the fourth day. He was discharged at the end of three weeks and has had no trouble since.

OBSTRUCTION OF CYSTIC BILE-DUCT BY ENLARGED LYMPH-NODE

This patient, an Italian barber, thirty-three years old, was admitted to the Northeastern Hospital on December 14, 1922. He cannot speak English well and the exact history of the preoperative developments is very difficult to obtain. On admission he had severe abdominal pain, particularly in the right hypogastrium, with very acute tenderness and marked rigidity, and there was a marked sense of resistance suggesting a mass in the region of the gall-bladder. He says that about five weeks before admission for the first time he began to have abdominal pain, which has continued ever since, with some remissions, but a tendency to increase in severity. He managed to keep at his work more or less until about two weeks ago. He said the pain was always aggravated after eating a meal. Occasionally he had nausea and vomiting. He drank alcohol heavily until about two years ago. Now shows slight jaundice, especially in the conjunctiva, and is anxious for an operation on account of the long-continued severe pain.

Operation December 15th: A right rectus incision about 6 inches long was made, and on retracting its margins the gall-bladder, tensely filled, projected from the lower margin of the liver 2½ to 3 inches against the anterior abdominal wall. It was surrounded by an adherent omentum around its whole border and underneath. Its walls were thickened and had a pinkish, inflamed color. The severe pain, the tension in the gall-bladder, and its color suggested the possibility of pus, so that the abdomen was packed off with gauze pads and the contents drawn off through a trocar and cannula. This was a mucopus with no evidence of bile in it, which indicated a complete obstruction of the cystic duct, the common cause of which is a gall-stone impaction. Palpation showed much inflammatory thickening of the whole gall-bladder, which was very marked in the region of the foramen of Winslow and gastrohepatic omentum. This indurated, irregular thickening involved the cystic, hepatic, and common ducts, but palpation could not detect evidence of a gall-stone anywhere. An effort was made to reach the neck of the gall-bladder by the finger inside the gall-bladder, but without finding a stone. Because of the purulent contents and because it had been expected that an obstructing stone would be found and removed, it had been intended that cholecystostomy would be performed for drainage, but the complete obstruction of the cystic duct would permit no drainage, except of the gall-bladder, which if left in must have resulted in a more or less permanent suppurating sinus. Only a cholecystectomy would meet the indications, but to enucleate the gall-bladder and cystic duct from this indurated and extensive inflammatory mass looked like a dangerous procedure, especially when it came to locating and dividing the cystic duct and artery. As there seemed nothing else to do, it was begun in the usual manner, the thickened serous layer being incised about an inch from the liver attachment all around. A line of cleavage was soon obtained and the enucleation proved to be very much easier than anticipated, even to the isolation of the cystic duct, which was very large and irregularly dilated back of the constricted portion. This constricted portion with the cystic artery was clamped by an artery forceps and divided.

When the gall-bladder was removed the most interesting phase of the case presented itself, and it was for this that the case is here presented. There had been very little in the history to justify the diagnosis of gall-stones. Thirty-three years was an early age for this condition. The patient had never had an attack of pain in this region before and he was not fat. Usually in such gall-bladders one or more stones are found as well as considerable bile. Here there was no gall-stone and the fluid contents showed no visible evidence of bile. When the specimen was examined it was seen that the cystic duct had been cut across just proximal to the dilated portion, that is, at the site of the obstruction. It was of normal caliber at the site of section and almost immediately to the gall-bladder side of this it dilated suddenly and markedly. On what was apparently the upper surface of the cystic duct was an enlarged and indurated lymph-node very closely and very firmly adherent to the dilated cystic duct. The constriction seems to have been immediately underneath almost the whole of the gland. The section of the duct was underneath this gland as well as the ligated portion of the duct which was not removed (Fig. 11). That the gland produced the obstruction is indicated by the fact that absolutely no visible sign of a stone or bile was found, that the gland was lying on and closely adhered to the duct, and that the constriction was clearly underneath the gland. This is the nearest

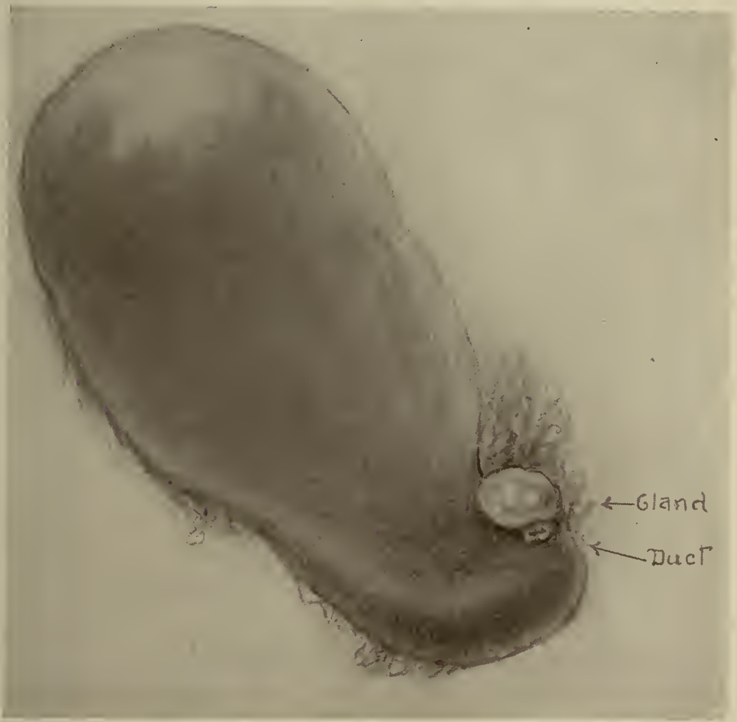

Fig. 11.—Note how the wide dilatation of the cystic duct begins immediately distal to the compressed sectioned, normal portion of the duct. The gland overlaid and compressed the portion of the duct internal to the section which formed the ligated stump.

that I have ever come to obtaining demonstrable evidence that an enlarged lymph-node can completely obstruct the cystic duct. The patient left the hospital at the end of six weeks with a very free purulent discharge from the drainage opening. On March 1st the drainage was very slight, and the prospects were for a complete disappearance of his symptoms.

A CONGENITAL INFANTILE INGUINAL HERNIA

A man forty-two years old on December 7, 1922 was admitted to the ward of the Philadelphia General Hospital. He was intoxicated, was in delirium and had hallucinations, but quieted down within forty-eight hours. On 12/15/22 it is noted that he has been up and about the ward for two days. He says that he feels good and declines to be discharged until he has had his hernia (left inguinal) operated on. He was transferred to the surgical ward on that day. This patient has a good physique, but is a chronic alcoholic and a heavy cigarette smoker. His heart and lungs are negative. He says he often gets nervous spells, especially after drinking, and his hands tremble.

In May, 1918, while in the Army, after some heavy lifting he first observed pain in his left inguinal region. Operation was recommended, but declined. He has worn a truss since July, 1918, but has continued to have considerable discomfort and at times much pain as the result of the hernia. Abdominal cramps came on frequently and caused vomiting. He had before admission on 12/6/22 his most severe attack which lasted ten hours, and was associated with nausea, vomiting, and abdominal pain, which he said was almost unbearable. This decided him to come to the hospital for operation. His hernia was indirect and complete.

Operation 12/18/22: The usual incision was made for a Bassini operation and the cord exposed. When this was examined a narrow sac was discovered and opened. It was easily large enough to admit the index-finger, which could not be passed upward inside the sac into the abdominal cavity, but stopped abruptly about the internal ring. The finger carried downward in this sac found itself in contact with the testicle. We evidently had here a tunica vaginalis extending with a wide lumen up to the internal ring, or a vaginal process of peritoneum which had closed only at the internal ring. A hernia could not have entered this peritoneal sac, and as he had shown a hernia before operation a search was made for another sac. This was discovered behind the cord and was opened. It had a moderately wide lumen extending about 3 inches downward from the internal ring; in stripping it up from the surrounding fat it seemed to extend in the form of a cord down into the scrotum. With a little difficulty a curved Kelly artery forceps was introduced into this narrower portion of the sac its whole length, which was for about 3 or 4 inches below the larger portion already described. The wall of this narrower portion seemed to be cicatricially thickened, but somewhat irregular in course and caliber, and required considerale dissection to free it, after which it was ligated at the internal ring and removed, the regular Bassini operation being complete. The excess of the vaginal process of peritoneum was also removed. The healing was uneventful.

The most important feature of this case was that we were dealing here with what we have long known as an infantile congenital inguinal hernia in which one must cut through three layers of peritoneum before reaching the hernial contents. There are probably few surgical conditions more thoroughly studied anatomically than inguinal hernia probably in the days when there were not many surgical conditions to study. Later generations of medical students have been compelled to study and learn many of these overdeveloped anatomic studies because of these early efforts. The writer had long thought that this special variety of hernia might be classed among the surgical curiosities, but this is the second case of the kind which he has seen.

POSTERIOR DISLOCATION OF THE SHOULDER-JOINT, WITH OBSTETRIC PALSY

This case is of special interest in connection with the recent very interesting paper of T. Wingate Todd (Annals of Surgery, July, 1922) on a study of the skeletons of 730 bodies in the dissecting room, among which he found 3 skeletons with this shoulder condition, 2 of them bilateral and 1 unilateral, or 5 abnormal shoulder-joints. Important as the effort is to establish the genuineness of the specimens, and brief as the space here for its discussion, I would question Todd's conclusions. I would prefer to believe that these specimens are examples of postnatal subacromial dislocations with a wearing away of the glenoid posteriorly by the long-continued pressure of the dislocated humeral head. Todd says of one of the specimens that its bilateral nature precluded "the possibility of its being considered other than congenital." I have had one bilateral case of recurrent posterior dislocation resulting from epileptic convulsions, and the displacement was of about the same mild grade as in the common congenital variety. The tilting of the acromion, described by Todd, more than anything else would in my opinion exclude these specimens from the congenital class. Todd says that the acromion was "more tilted than usual and had its dorsal edge on a much lower plane than its ventral margin." Instead of an exaggeration of the normal obliquity of the acromion it is reversed in the congenital variety, and instead of the dorsal edge being on a much lower plane than the ventral, the ventral is usually on a much lower plane than the dorsal. I believe this is due to abnormal pressure on the upper surface of the antero-external portion of the acromion by the bony maternal pelvis during delivery. In this case, although this depressed cartilaginous anterior portion was elevated at operation, the anterior margin of the acromion is still lower than the posterior or dorsal edge. We have, however, in this case a confirmation of the very important points emphasized by Todd that these congenital dislocations are rarely, if ever, fully reduced by the operations done for this purpose.

Todd says this is because the glenoid cavity is set further back than in the normal and that we are dealing here with an apparent, not a real, dislocation. I have done a fair number of operations to accomplish reduction in these cases, but I doubt whether I have ever been successful, although I have never done an operation which was afterward regretted by myself, the patient, or relatives of the patient. The improvement in motion is always very satisfactory. In this case the dislocation persists and is perhaps slightly greater than before the operation, but the range of motion and power of the limb are almost as good in the affected as in the normal limb.

I saw and examined this patient first on March 3, 1916. He was a boy four months old. The head presented and he weighed 10½ pounds at birth. The chief difficulty was in delivering the shoulders, especially the left, the doctor finding it necessary to hook his finger under the axilla and pull on this, the left side. He thought that he must have dislocated the shoulder. Paralysis of the left arm was not noticed until three days after birth, when it was complete except for slight movement of the fingers. Examination now (March 3, 1916) shows a posterior subluxation of the left shoulder-joint with a characteristic marked internal rotation of the whole limb and with marked limitation of passive abduction and external rotation at the shoulder. There is slight limitation of passive extension and flexion at the elbow and slight cubitus varus deformity, an elbow condition commonly associated with these birth palsies.

The child voluntarily elevates the arm forward to a little above a right angle with the body. During the examination of the shoulder movements a "click" was obtained and immediately afterward the child began to cry. The mother says that the child often cried when pressure was made in the left axilla, which tends to show that most trauma occurred about this joint.

Operation March 17, 1916: Incision around the margin of the acromion through the deltoid (Fig. 12, No. 1). The typically

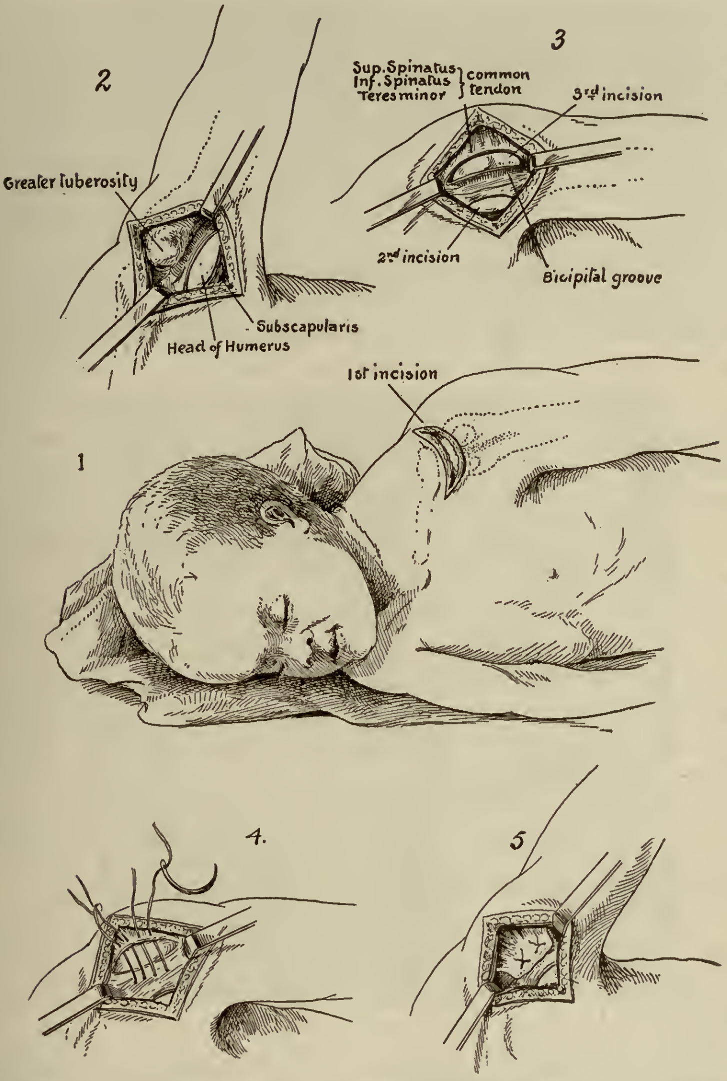

Fig. 12.—Illustrating steps of operation usually performed by writer: 1, Incision just below margin of acromion through skin, fascia, and deltoid. 2, Division of subscapularis tendon and joint capsule close to their attachment to the lesser tuberosity, overcoming restriction of external rotation and abduction. 3, Division of common tendon of external rotator tendons and joint capsule close to their attachment to greater tuberosity. 4 and 5, Overlapping of common tendon on greater tuberosity to increase and maintain external rotation.

bent down anterior portion of the acromion, which is cartilaginous, was lifted up toward its normal level as far as possible and left in this condition. The subscapularis tendon was divided completely at its insertion into the lesser tuberosity to allow as full external rotation as possible (Fig. 12, No. 2). This also permitted about full abduction. To maintain the external rotation the external rotator tendons were divided at their insertions into the greater tuberosity (Fig. 12, No. 3) and the divided ends fixed as far forward as possible on the surface of the greater tuberosity by two catgut sutures (Fig. 12, Nos. 4 and 5). The cut deltoid margins were reunited by a continuous catgut suture with some difficulty owing to the necessity of keeping the arm in abduction and external rotation to prevent breaking the sutures holding the cut external rotator tendons forward on the greater tuberosity. A continuous catgut suture closed the skin wound completely, a sterile dressing was applied, and a plaster cast maintaining the arm in as nearly full abduction and external rotation as possible (Fig. 13, B). Primary healing occurred and the patient was taken home with the arm in a cast on March 27, 1916. The cast was removed April 16th and the arm came down to about 140 degrees. The divided cast was then reapplied for support of the arm. On March 23d it came down to about 60 degrees when the child was in the upright position. The mother said that he moved the arm up and down from the original cast position to this limit of 60 degrees easily and freely while in the recumbent position.

April 30th the arm came down almost to the side of the trunk. October 20, 1916 the mother says she can see scarcely any difference in the active and passive movements of the two arms.

September 11, 1919: There is a very slight limitation of abduction and external rotation. The affected arm seems to be just as strong as the other, but he does not use it quite as freely as the other.

December 28, 1922: The mother and the patient both say that they see practically no difference in the use of the two arms (Fig. 13, C and D), although the affected arm is still

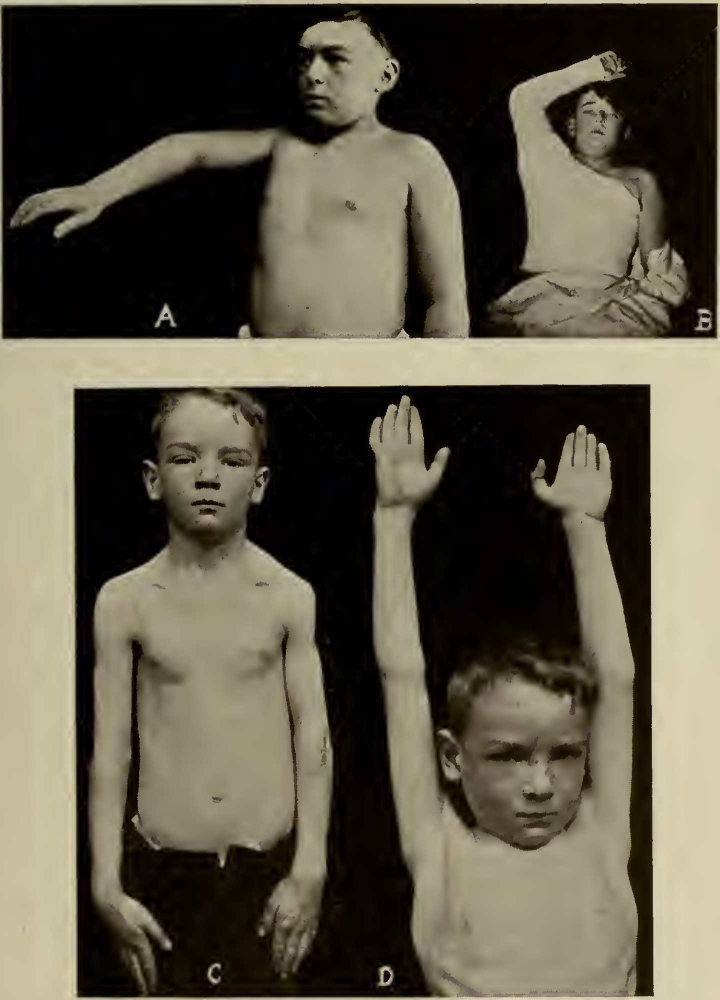

Fig. 13.—*A* shows rather more than the usual limitation of abduction and external rotation at this age in another patient before operation, and *B*, the usual cast position after operation. *C* shows the patient here reported at the present time with the arms at the side. Note the changed contour of the affected left shoulder as compared with the normal right shoulder. *D* shows normal elevation and supination of left arm without abnormal movement of scapula.

slightly shorter than the other and the dislocation is probably slightly more marked than before operation. This is probably due to the humeral head working itself backward into a position where it is less confined under the deformed acromion and more free to act. I have seen this occur in other cases after operation, always to the advantage of the patient in increased motion.

COMPOUND DOUBLE FRACTURE OF THE LEG WITH PRIMARY CLOSURE

This case, although its course has not yet been completed, is discussed here because its progress thus far has been sufficiently interesting to justify it. To appreciate the facts in this case it will be necessary to make brief reference to a paper which appeared in the Journal of the American Medical Association August 5, 1922. In that paper the position was taken that most compound fractures were due to indirect violence and consequently the compounding skin wound to protrusion of the sharp fragment end. According to this view there was no infection in the wound except in so far as the usual briefly protruding fragment gathered infection from contact with surrounding objects, as clothes, and carried it back into the wound. It was assumed that in such cases thorough swabbing of the wound with tincture of iodin followed by alcohol would destroy such infection.

Thirteen cases were reported in which the wound in each was closed without drainage, and in the later cases completely covered by a plaster cast. In some an extension cast was applied to adjust and fix the fragments, and in others plates and screws and plaster cast were employed. The 13 cases reported may be divided very crudely into two groups: in the first 6 the cast did not cover the wound, which could be and was exposed early. In the remaining 7 the wound was completely covered by the cast, and in no case was the cast removed sooner than two weeks after its application, in one case 9 weeks afterward. In 3 of the first group primary healing was obtained, and in 3 secondary healing; in 2 of the second group primary healing and in 5 secondary healing. One of the outstanding phases is that in the 3 of the first group, healing secondarily, there was very little evidence of infection, but the slight quantity of pus burrowed deeply and slowly and small pieces of dead bone were discharged from time to time. In the secondary healing cases of the second group there was no burrowing of pus and no sequestrum of dead bone discharged. In presenting this case no space will be taken up with any attempt to explain what happened, but merely to relate it.

The most interesting of the 13 cases already reported was one in which discharge resembling pus occurred, but with no local or constitutional signs of infection. The small area of denuded bone presenting in the wound was expected later to undergo necrosis and sequestration, but became completely covered by healthy granulation which healed over without any evidence of sequestration. This new case is now presented in its incomplete stage chiefly because its progress is in many respects related to the one just referred to.

On August 5, 1922 a ninteen-year-old mill hand sustained a compound fracture of the leg below the middle in an automobile accident. I was present when he was brought into the receiving ward of the Northeastern Hospital and saw the leg as soon as it was exposed. It was smeared over with blood and dirt and there was a transverse wound about $\frac{3}{4}$ inch long, bleeding freely. It was flail at the seat of fracture, that is, buckled up easily. Posteriorly there was another small skin wound on about the same level as the first, and was probably due to a protruding fibular fragment, as the anterior wound was probably due to a tibial fragment. About an hour later recovery from shock seemed to be sufficient to justify operation, which was proceeded with without waiting for an x-ray. Later developments showed that an x-ray would have been advantageous.

The leg was shaved, washed with tincture of green soap and sterile water, and dried. The whole leg was then painted with tincture of iodin, this washed off with alcohol, and the field of operation draped by sterile sheets and towels in the usual manner. The interior of the wound was then swabbed out thoroughly by tincture of iodin on a gauze pad in the grasp of an artery forceps and the iodin followed by alcohol. A longitudinal incision about 8 inches long was made over the tibia through the compounding wound, exposing the fragments. It was now first discovered that there were two nearly transverse lines of fracture isolating a fragment of the tibia 3 to 4 inches long, displaced markedly inward, with considerable deformity at each end. The adjustment was difficult and prolonged and resulted finally in the complete detachment of this isolated fragment. Of course this complicated matters very much and raised the question as to what to do with this fragment—leave it out or replace it. If infection set in, it could not in all probability regain attachment to the surrounding tissues without which it could not live. In the latter case the resultant bone defect would be difficult to fill in. It was decided to retain the fragment and fit it in position, which was accomplished after much difficulty, and all three fragments fixed by a Lane plate having eight screw holes, the two medial holes and screws being used for the middle fragment and three each for the other two fragments. The most difficult problem in the open treatment of fractures is, in my opinion, not that of infection, but of immovable fixation of the fragments. Movements of the fragment ends on each other is the most important factor, with the usual aseptic technic, in starting trouble in the wound. For this reason ordinary wood screws, on account of the length of the screw and the depth of the thread, were employed, and were made to pass through the whole thickness of bone and take firm hold of both layers of compact bone (Fig. 14). The wound was now swabbed out with dichloramin-T and closed without drainage, with a continuous No. 2 chromic gut suture. Sterile gauze moistened with alcohol was applied and bandaged and a plaster cast from the middle of the thigh, to and including the foot, without any opening in it.

On 8/9 it was noted there had been no local or constitutional signs of infection since operation.

On 8/21 there had been no complaint of pain and no other local or constitutional symptoms of infection, but because of concern about the fate of the detached fragment the wound was exposed through a cast opening. The gauze was saturated with a discharge that was more serous than purulent and both wound margins about over the detached fragment were undergoing necrosis out to the line of sutures on each side, where the necrosis stopped sharply. The plate was visible at one point, but there was no evidence of infection in the surrounding skin or deeper tissues. Very little moisture remained in the wound after removal of the dressing, that is, the gauze, had soaked it up practically entirely. Sterile gauze moistened with dichloramin-T was applied and covered with more gauze and a bandage.

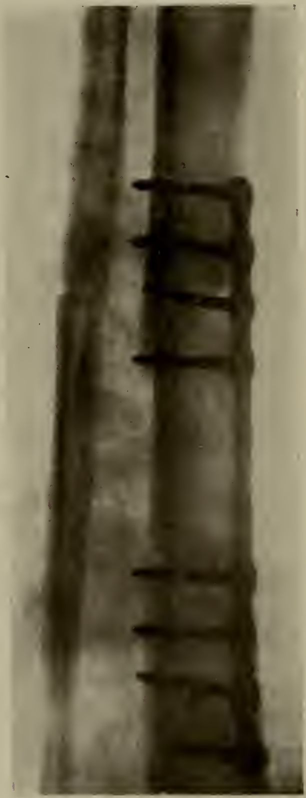

Fig. 14.—Note that seven of the eight screws pass through the whole bone. The eighth did not take hold, so that a thicker one was necessary, and the only available one was short. A longer and more rigid plate was desired, but not available.

On 8/26 wound again exposed, dressing moist, and there was a smell of dichloramin-T, but not a foul odor. Most of the necrotic tissue seen five days before had largely shriveled and the wound gaped for the length of about 6 inches to the width of about 1½ inches in its widest part. This gaping portion lay about over the middle, or isolated fragment, including about 1½ inches below it and about 1 inch above it. The bone in this

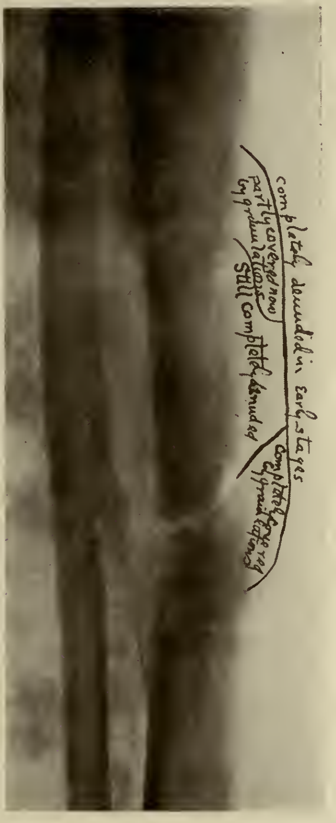
completely denuded in early stages
partly covered now by granulations
Still completely denuded
completely covered by granulations

Fig. 15.—Same lateral view as in Fig. 14, five months after the accident and operation. One of these two is a reversed exposure, *i. e.*, on the wrong side of the film as shown by the fracture of the fibula. Although the wound surface portions of all three fragments show rarefaction, that of the lowest is covered completely by granulation tissue which is adherent to the bone surface. The upper fragment is partly covered, but the middle one not at all.

area of all three fragments is denuded of periosteum and has the usual grayish appearance suggesting that superficial necrosis and sequestration will be likely to occur later. There are no local or constitutional signs of infection except the already mentioned necrotic tissue and the discharge. The patient can move the fragments together within the cast, but not on each other. Dichloramin-T dressing.

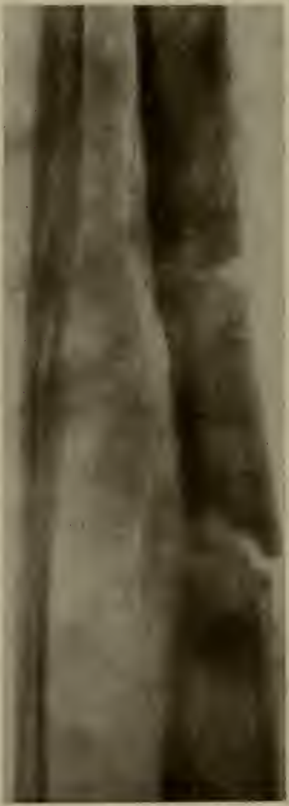

Fig. 16.—Anteroposterior exposure five months after the accident and operation. The density, external margins, and central cavity are about as definite in the middle as in the other two fragments. Note the evidence of callus in this and Fig. 17. No callus can be detected by the probe in either line of fracture.

These quotations from the postoperative notes will answer largely for all those taken. Until a few weeks ago dressings were done about once a week, the interval never being less than five days, sometimes as long as nine days, convenience being chiefly responsible for the difference. In the longer period an odor would develop. The dangers of infection have given little or no concern, the vitality of the isolated fragment being the disturbing question. Outstanding features of the case have been the absence of the usual signs of infection and of real pus. There has been no evidence of pus developing around or under the fragments or at the lines of fracture which are filled with granulation tissue. It is now almost seven months since the accident and operation, and there has yet to appear the slightest evidence of loosening of pieces of dead bone. In one of the early dressings a small piece of detached bone came out in the gauze, but this had clearly been detached in the accident. Granulation tissue has long filled in the visible drill holes of the upper and lower fragments and the lines of fracture, especially the lower line of fracture, where it is abundant. It has appeared at the upper of the two drill holes in the medial fragment. One of the most interesting observations is that granulation tissue is slowly growing over the previously denuded portions of the upper and lower fragments, especially the lower, and these granulations are becoming adherent to the bone surface. This is shown when one tries to lift them from the bone with a probe. There is really some question as to whether these granulations are growing out of the bone or are growing from the surrounding soft tissues and becoming adherent to the bone (Fig. 17).

Is the middle fragment living? I think it is, but with poorer nutrition than the two main fragments. The poor nutrition is shown by the failure of the drill holes to become filled with granulations and failure of granulations to grow over this fragment from the sides, or to grow out of it, as in the other two fragments. That it is alive is shown by the failure of pus to develop under and around it or at the lines of fracture which are filled by granulation tissue, the difficulty of moving this fragment by pressure on or grasping it with forceps and the absence of any signs of sequestration after nearly seven months point in the same direction. The best evidence, however, is in the x-ray, which seems to show that this middle fragment is alive, and that callus is uniting it to the other two fragments (Figs. 15, 16).

January 6, 1923: Patient has been walking on the cast about ten days. With a good light both lines of fracture were observed closely as he successively took the weight and released it as in walking. All fragments moved up and down together without any motion on each other at the fracture lines.

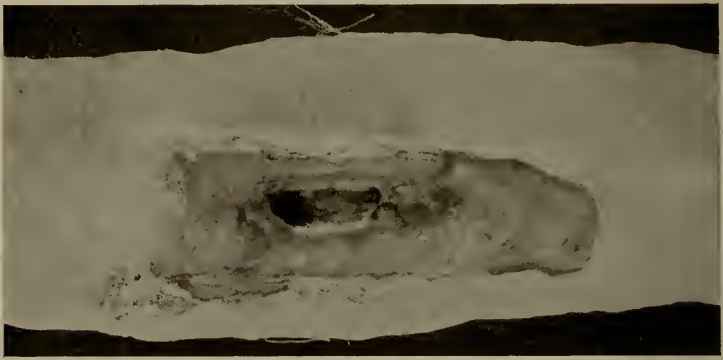

Fig. 17.—Appearance of wound five months after fracture and operation and after removal of five-day gauze dressing without any attempt to cleanse the skin or wound surface. The surface of the middle fragment, almost black and entirely bare, can be seen in the center. The upper and lower fragments are covered by granulation tissue.

February 26, 1923: Cast removed today. Wound healed almost to the margins of the middle fragment, the surface of which is still completely uncovered by granulation tissue. Very little wound discharge and none coming from the fracture lines or from the depths around the fragments. The x-ray taken today shows clearly a thicker line of callus extending along the middle fragment from the upper to the lower one. Manipulation of the leg seems to show firm union, and the cast is not to be reapplied.

CLINIC OF DR. JOHN H. JOPSON

Presbyterian Hospital

CARBUNCLE OF BACK OF NECK. EXCISION OF CARBUNCLE BY THE ELECTROCAUTERY KNIFE, FOLLOWED BY CARREL-DAKIN TREATMENT OF WOUND

Nearly every year we have on our service at the Presbyterian Hospital several cases of carbuncle admitted to the wards. Our proximity to several homes for old people, who refer to us their patients, explains the rather unusual number of these cases which we see, especially during the winter. Recently we had 4 cases of carbuncle in the ward at the same time. In none of them was diabetes the underlying cause. The present case is a fair example of the more severe type. He is sixty-eight years of age, an inmate of the Old Man's Home, and is a sturdy old gentleman, otherwise in good health. Duration of the carbuncle is three weeks. When admitted (January 21, 1923) he was suffering great pain, was unable to sleep, and showed a carbuncle situated on the nape of the neck with induration extending laterally from ear to ear, and as high in the scalp as the inion. The central area showed a number of small discrete sloughing openings. The temperature was but slightly elevated, 99½° to 100½° F. He had a leukocytosis of 18,000.

For some time we have been in the habit of excising the affected area, including all of the openings of the carbuncle and the underlying infected and infiltrated connective and fatty tissue, with the electrocautery knife. This method was brought to our attention by Dr. A. C. Scott, of Temple, Texas, who has found it efficient in quite a large series of cases of carbuncle. Dr. Scott is also enthusiastic in the use of the same method for the radical excision of malignant disease, in which field we have not followed his recommendations. In cases in which we have used it for the excision of carbuncles it has justified the claims which Scott makes for the method, but for which he does not claim originality, as it is a method of treatment which has been occasionally used for a number of years. It has the advantage over knife excision in that it is not attended by hemorrhage, which otherwise may be severe, that it sterilizes the infected area which it traverses, and temporarily seals up the blood-vessel and channels surrounding the area excised. It permits of the excision of large carbuncles in debilitated patients with a minimum of shock. We have observed that, as Scott remarks, the pain is almost immediately controlled after such cautery excision. There is a very limited sloughing of the large cauterized and sterilized wound surface which remains. Such slough as adheres to the wound yields quickly to Dakinization, and, if desired, healing can be hastened by the early application of skin-grafts (Fig. 18). In this case cautery excision was practised, and a skin area about 2½ inches in diameter was removed, including practically all of the necrotic and suppurating skin tissue. This

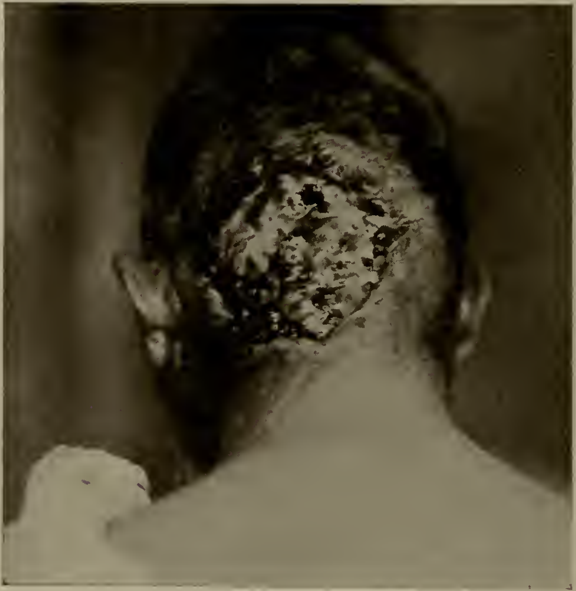

Fig. 18.—Appearance during early stage of Dakinization. The surrounding induration has subsided. Some adherent slough remains.

excision included the underlying area of slough, which was dissected out with the cautery knife *en bloc* to the deep fascia. The surrounding flaps were then elevated by point dissection with the hot knife, opening up outlying pus pockets, which sizzled and steamed as they were evacuated. When all the infected area had been penetrated and drained, which was accomplished without hemorrhage, the wound was packed with strips of gauze saturated in Dakin solution. The pain was relieved almost immediately and the temperature promptly declined to normal. The Dakin tubes were inserted on the second day, and systematic irrigation of the wound begun. He is still in the hospital, after two weeks.

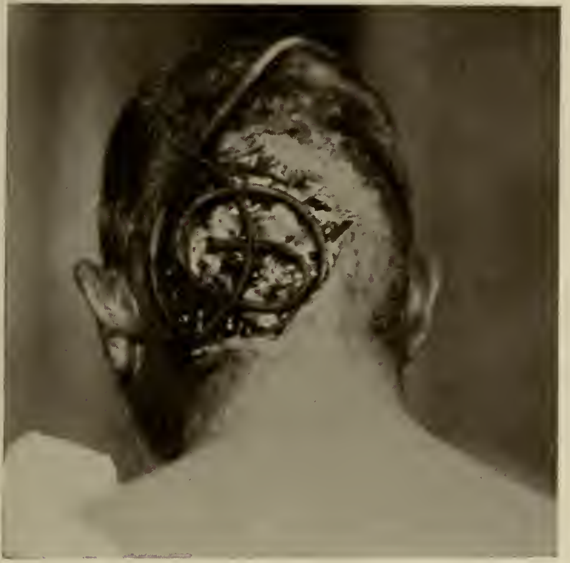

Fig. 19.—Arrangement of tubes for Dakinization after excision.

The illustration shows the method of Dakinization (Fig. 19). There is less tendency for the circular tubes to be displaced than where we use two or three straight tubes for the irrigation, as is the usual custom. My house-surgeon, Dr. Cooper, made this particular one.

Another illustration shows the appearance of another carbuncle after operation, in a case in the ward at the same time, and operated on a few days before the first by my associate, Dr. Damon B. Pfeiffer (Fig. 20). In this case the carbuncle was excised with a knife. Like the first, it was of three weeks' duration, and was located in the midscapular region. Dakinization was begun on the second day, and the progress of this patient has been very satisfactory. The wound has reached the stage where skin-grafting could be practised with advantage, and would hasten complete healing, which occurs even in the ungrafted cases with surprising rapidity, due to the contraction of the healing wound.

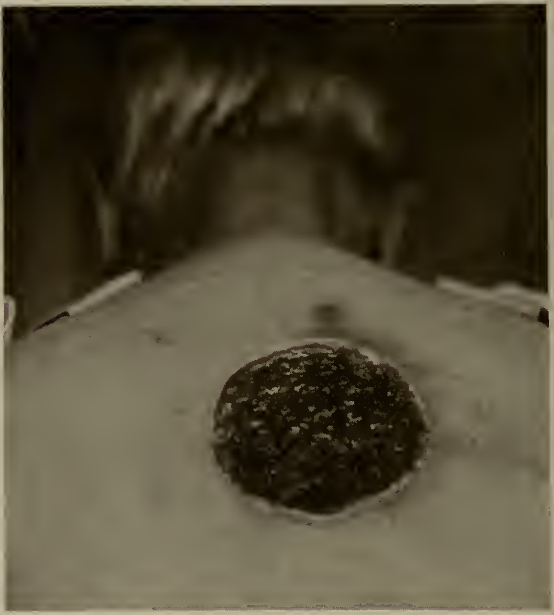

Fig. 20.—Carbuncle after Dakinization. It is ready for skin-grafting.

In none of the cases we have treated in this manner has glycosuria been present. In some the blood-sugar percentage has been taken, and the highest figure reached was 120 milligrams per 100 c.c. of blood. Gas and oxygen are used for a general anesthetic. One old gentleman on whom we operated by this technic for a large carbuncle of the neck was out of bed the same afternoon and contentedly enjoying his pipe in the patient's smoking room.

CARCINOMA OF THE TRANSVERSE COLON. INTESTINAL OBSTRUCTION. OPERATION IN SEVERAL STAGES BY THE MIKULICZ METHOD

H. B., WHITE female, aged sixty-two years. Had been well until one year ago, when she began to have "indigestion," in the shape of vague pains and discomfort in the epigastrium, at times sharp, at other times dull and aching. These attacks were irregular as to time, separated by days or weeks, and bore no relationship to her meals. She had gaseous eructations, which gave her some relief, and a burning sensation in the upper abdomen, but never vomited, and the bowels were not constipated, although at times she described the movements as "explosive." These also gave her relief, and she expelled considerable flatus. Her weight and general nutrition were well maintained, and she was otherwise in fair health. These symptoms have persisted and increased in severity. One week before admission the pain became very severe, starting in the region of the umbilicus and radiating to the right lower abdomen. She was nauseated and vomited a bilious material. During the three days preceding admission the pains progressed in frequency, were intermittent, sharp and cramp-like, and she described the feeling to be as if the intestines were rolling into a knot in the right lower quadrant. The bowels moved daily until the day of admission, when enemas were given, but only gas was expelled.

The history was quite characteristic of an obstruction of gradual development, and probably of malignant origin. When examined on the day of admission (December 7, 1922) the patient was in good condition, moderately distended, and with some abdominal rigidity. She was well nourished, somewhat anemic, but exhibited no cachexia. During the examination she had one of the cramp-like attacks, and the peristaltic wave could be seen to roll across the abdomen from left to right into the iliac region, with a very marked distention of the affected coil of bowel. Immediate operation was decided upon. The probable diagnosis was a chronic obstruction from malignant growth in the colon.

The abdomen was opened through the right rectus muscle. It contained a moderate amount of clear fluid. The cecum was greatly distended, as was the ascending colon to a lesser degree. There was a narrow band-like stenosing scirrhous growth in the transverse colon, about 2 inches beyond the hepatic flexure. No enlarged glands could be observed or palpated. The case was favorable for radical operation from the standpoint of malignancy and from the absence of metastasis. It was, however, complicated by an obstruction which was practically complete. The bowel proximal to the obstruction was loaded with a highly septic content. The surgical problem was first to relieve the obstruction, and secondarily to eradicate the affected loop of gut and adjacent mesentery, and to restore the continuity of the intestinal canal. The one-stage operation is not applicable in this type of case. It is "ideal" in name only, and not to be considered in cases of obstruction of the colon. It is in such a type of case that the Mikulicz "two-stage" or, as in this case, "many-stage" operation is most striking in its applicability and results.

The first step consisted in the mobilization of the affected portion of the colon, including the hepatic flexure and the proximal portion of the transverse colon. The mesocolon was divided near its origin, the vessels were clamped and ligated, and the limbs of the mobilized loop were approximated by suture of the edges of the divided mesentery. This permitted the mobilized gut, with the tumor in its center, to be brought out through an oblique intramuscular incision, near the anterior superior iliac spine. It was anchored to the peritoneum and muscularis by two mattress-sutures passing through these structures and the mesentery in opposite directions. The angles of the peritoneal incision were stitched to the sides of the loop. Two Paul tubes were then inserted into the protruding gut, one on each side of the tumor, through small lateral incisions in the bowel, and fixed by purse-string sutures. The primary rectus incision had been closed in layers before opening the bowel, and sealed with an occlusive collodion dressing.

By this method the acute symptoms of obstruction were controlled, although there was little drainage from the intestine for the first forty-eight hours. At the end of that time the patient was in good condition, and was seen with us by Dr. Charles Mixter, of Boston, who suggested washing out the distended and paralyzed cecum through the proximal opening, which was accordingly done after removal of Paul's tube, with marked and

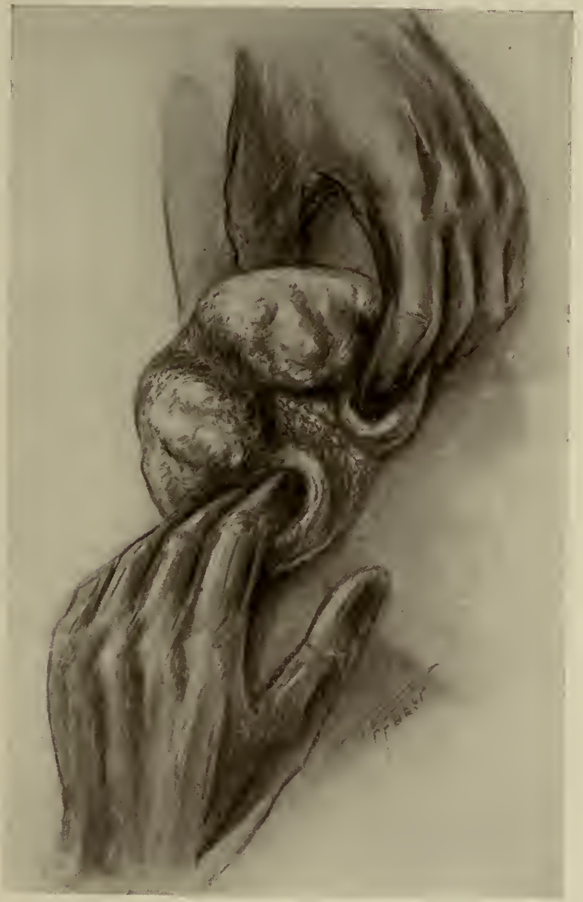

Fig. 21.—The tumor and neighboring gut are prepared for resection. The site of the colostomy openings is indicated.

immediate benefit. Dr. Mixter informs us that in some of these cases his father had been accustomed to perform a cecostomy in addition to the usual technic, fastening his Mixter tube in the cecum and bringing it out through a separate stab-wound. In this case the administration of eserin and strychnin at this time hastened the evacuation of the distended intestines. The pa-

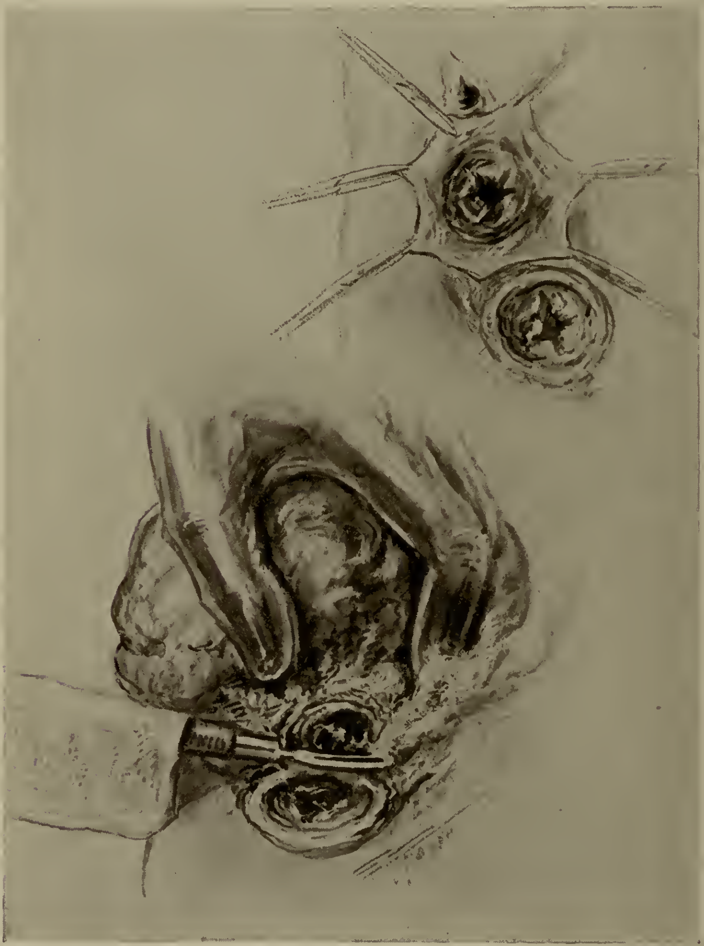

Fig. 22.—Excision of gut flush with skin by electric cautery. Above, relation of ends of resected colon.

tient's progress thereafter was very satisfactory. Irrigation of the cecum through the proximal opening was repeated on the following day. The protruding bowel showed no tendency to slough, which sometimes occurs after wide mesenteric ligation.

The second-stage operation was performed on December 15th, eight days after the first (Fig. 21). The protruding loop of colon, and mesentery including the growth, was excised by the electrocautery close to the skin edges, after preliminary irrigation of the gut (Fig. 22). Several vessels required ligation. There was marked tendency of the distal end of the bowel to retract. The edges of both openings were sutured to the skin (Fig. 23).

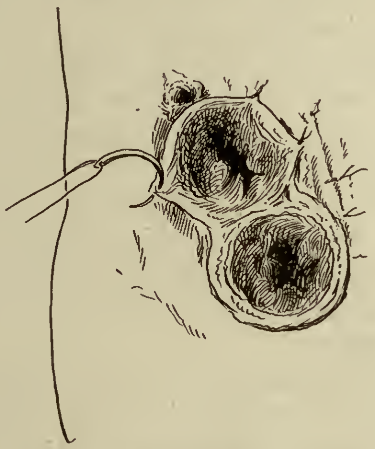

Fig. 23.—Fixation of bowel ends by suture to avoid premature retraction

The preliminary wound through the rectus muscle was clean and healed by primary union.

A third stage consisted in division of the spur separating the proximal and distal segments through the double-barreled opening, which now presented on the abdominal wall. Preliminary digtial examination showed close approximation of the afferent and efferent limbs of the gut for several inches. On December 29th a Dupuytren's clamp was applied to this septum, the patient being given a little gas and oxygen for this procedure. The clamp was tightened on successive days, cut its way through, and was removed after five days.

On January 19, 1923 the colostomy opening was closed. The bowel was mobilized by cutting away the single opening from the surrounding skin, and by separation of the colon from the abdominal wall, working mainly through an area of adhesions, but thoroughly mobilizing it until it fell away from the abdominal wall. The intestinal opening was sutured transversely by chromic catgut and overlying linen stitches. The abdominal wound was sutured and drained at its lower angle by a cigarette drain. No leakage occurred. The wound in the abdominal wall healed quickly and without infection. The bowels moved after three days, assisted by a small glycerin enema, to the patient's delight. She was discharged from the hospital completely healed on February 4th, eight and a half weeks after admission. Report of hospital pathologist, Dr. Eiman, is as follows:

"Gross: Specimen section of bowel 15 cm. long, very much thickened and indurated, and the outer surface of which is yellowish-green in color and covered by a necrotic-appearing exudate. There is a hard constricting growth present in the center of the specimen which has a striated white appearance, striation appearing to converge the concave surface of the bowel. On section, this tissue is light gray in color, surface presents smooth transparent appearance.

"Micro.: Adenocarcinoma. Excess of connective tissue."

We have described this case in some detail because it exemplifies practically all of the advantages of the Mikulicz technic. The operation is an old one, having been described by Mikulicz in 1902. Dr. Charles N. Dowd, of New York, has in recent years again emphasized the value of this method, and points out the reduction in mortality in different series of cases operated upon by himself and others, including Finkelstein, Mayo, and Tuttle. It is suitable to the resections of the colon from the hepatic flexure to the terminal sigmoid. Above the colon the fluid nature of the intestinal content and its moderate infective power render the one-stage operation generally appropriate except in cases of obstruction. The mortality of the Mikulicz operation is lower in colon resections, whether done in the presence of obstruction or as an operation at a time of election. The intestinal content of the large bowel is highly septic under any condition. This infective index is greatly increased in the presence of obstruction, while the resistance of the patient is much decreased. The method practically insures against peritoneal contamination with its high percentage of mortality. Dowd has reported a series of 19 cases of partial colectomy, with 1 death, and quotes other authors in whose series the mortality ranges from 12½ to 17 per cent. These figures are much lower than the average mortality for resection of the cnlon where other methods are included. There is no reason why this procedure cannot be combined with the independent cecostomy to drain a distended and paralyzed cecum, when the obstruction is located too far from the proximal colon to permit of spontaneous drainage through a colostomy opening. In desperate cases cecostomy alone may be practised, as Erdman prefers, and the Mikulicz procedure can then be carried out at a later date. If the tumor and the neighboring intestine, along with the mobilized lymphatics and mesentery, are cut away at the time of the first operation, as is usually done, both ends are ligated, but the proximal end may be drained at once or opened after twenty-four or forty-eight hours. Where obstruction is present immediate drainage by a Paul tube is advisable. In our case we preferred to resect the colon as a second-stage procedure, at the end of eight days. In some cases the slight additional time and additional shock accompanying primary excision might be an unfortunate determining factor. It may be said that this operation, aside from the advantages as regards insurance against peritoneal infection, is strictly in accordance with the prime principle in operative surgery, which limits each operative intervention, so as to keep it within the range of the patient's resistance, and in dangerous cases proceeds step by step to the goal.

COMPOUND FRACTURE OF TIBIA. FRACTURE OF PATELLA AND CONDYLES OF FEMUR, WITH SECONDARY SUPPURATIVE ARTHRITIS AND DESTRUCTION OF KNEE-JOINT. AMPUTATION OF THIGH AND CLOSURE BY SECONDARY SUTURE

THIS case is included to illustrate the advantages of the secondary closure of amputation wounds through infected tissue. It demonstrates our ability to sterilize wounds which if closed by primary suture would result in long-standing suppuration, and probably osteomyelitis and necrosis in the stump. This patient has been in the hospital for three months. His injury was sustained by having his right leg caught in the driving wheel of a locomotive while at his work as an oiler. When admitted he was suffering from shock and hemorrhage too severe to permit of a primary amputation. In addition to the injuries of the bones there was a very extensive contusion of the soft parts and a hematoma of the thigh. The fractures became infected, the knee-joint was disorganized, and there was very extensive sloughing of the skin of the leg and the thigh. At this time he was under the care of my colleague, Dr. Speese, and refused amputation. After three months of suffering and prolonged suppuration he finally consented to an amputation. On December 12, 1922 we amputated through the middle third of the thigh, using oblique flaps to avoid the inclusion of cicatricial tissue. It was observed that the subcutaneous tissue and the connective tissue generally were infiltrated and edematous. The muscles were also yellow and edematous. It seemed highly probably that the lymphatic tissues were infected at the site of formation of the flaps, and that if the wound were closed, suppuration could be expected. A delayed closure was, therefore, decided upon. This rendered the usual aperiosteal treatment of the bone unwise. It was, accordingly, sawed off flush with the point of division of the periosteum. The wound was packed with long strips of gauze saturated in Dakin's solution, and provisional sutures of silkworm-gut were used to secure them beneath the flaps; 2200 c.c. of salt solution were administered subpectorally by infusion during the operation, which was not attended by shock. Three days later the patient was given nitrous oxid gas and oxygen. The sutures were removed and the packing was taken out. It was very foul and saturated with pus (Fig. 24). Smears and cultures were made from this, and 12 Dakin tubes were applied to the face of the stump, and instructions given 50 c.c. of Dakin solution were to be injected at each irrigation thereafter (Fig. 25). Cultures showed Bacillus pyocyaneus and a few streptococci. Under Carreling the wound cleaned rapidly. The temperature only reached 100° F. one day after the amputation, and shortly thereafter

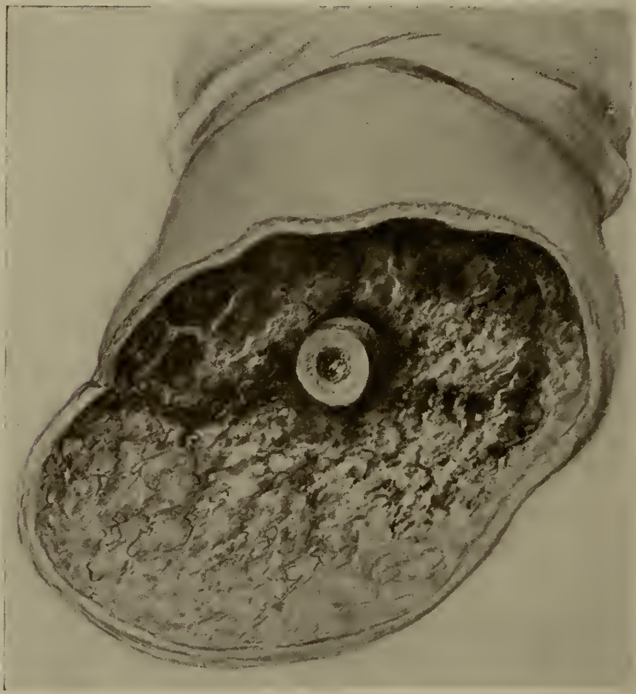

Fig. 24.—Appearance of amputation wound at the time of removal of provisional sutures and packing.

became and remained normal. Smears and cultures taken at frequent intervals after the beginning of the sterilization showed Bacillus pyocyaneus only on several occasions, and at other times Bacillus proteus. There were 75 bacteria per field in the smears on December 18th, 1 in 5 fields on December 23d, and none at all after this date. On December 29th, seventeen days after amputation had been practised, the wound was closed by secondary suture, the result of which was completely successful. Patient was out of bed ten days later, and in fourteen days the wound was solidly healed (Fig. 26).

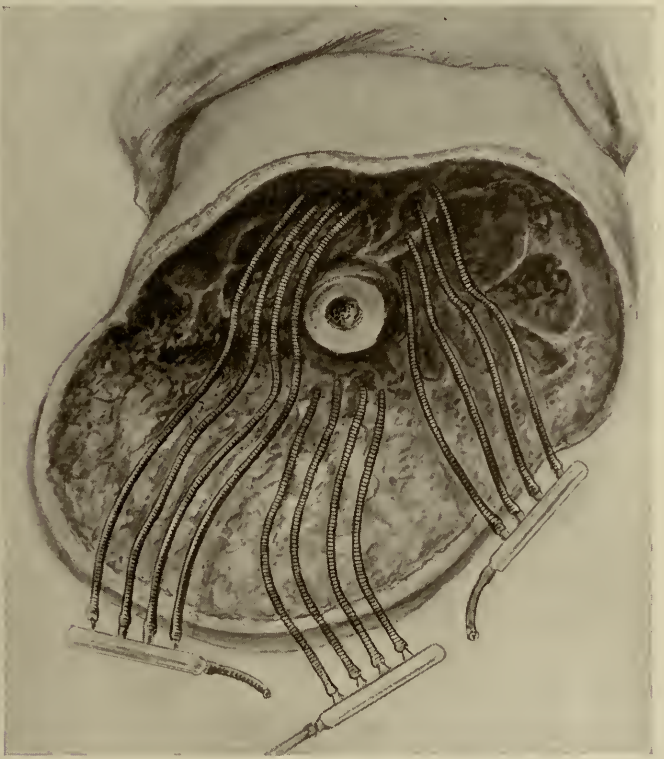

Fig. 25.—Arrangement of tubes for sterilization.

It is our opinion that the delayed closure of potentially injected wounds admits of a wider range of application than is generally understood. In acute traumatic surgery, and especially in the treatment of compound fractures of the large bones it is certainly indicated in many cases. We are not in sympathy with those methods of treatment which yield brilliant results in some cases, but are accompanied by a calculable percentage of lamentable results. The same principles of delayed closure are equally appropriate in chronic cases where infection is to be anticipated.

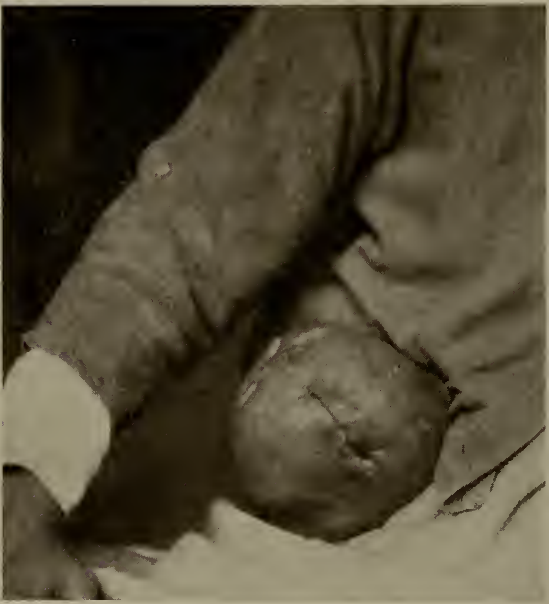

Fig. 26.—Appearance of healed stump after secondary suture and before discharge from the hospital.

TUMOR OF NECK. CARCINOMA; PRIMARY OR SECONDARY(?). REMOVAL OF TUMOR WITH RESECTION OF THE THREE CAROTIDS AND THE INTERNAL JUGULAR VEIN

The accompanying illustration was made from a specimen of tumor of the neck, removed by us two years ago, and which we show in order to place on record a case which presented some unusual points of interest both from a diagnostic and operative standpoint. The patient was an old man, seventy-three years of age, who presented himself with a tumor of the left side of the neck. It was of three or four months' duration. It was approximately 3 inches in diameter, hard, insensitive, slightly movable, and apparently more or less intimately attached to the great vessels. A careful examination of the patient included a laryngologic examination by Dr. A. H. Cleveland, and failed to show any primary malignant focus. A diagnosis of lymphosarcoma seemed most probable, although carotid tumor was also considered as a possible explanation. It was decided to attempt its removal. The operation was a difficult one, and we were forcibly reminded during its performance of some succinct remarks by Dr. J. Chalmers DaCosta when detailing his own experience with a case of carotid tumor. The technical problems were identical. Not only was the growth so firmly adherent to and fused with the carotids as to render its separation impossible, but, to make matters worse, the internal jugular vein ran through the growth and was infiltrated by it. A resection of the common, internal, and external carotid arteries was necessary along with the internal jugular vein. The former structures are shown in the illustration, lying on the posterior surface of the tumor, while the vein runs through it (Fig. 27). The common carotid was ligated first and cut across below the tumor, and the latter with the vessels separated from the underlying pneumogastric nerve, from below upward. The portion of the sternocleidomastoid muscle overlying the growth was removed with it.

The vessels were then ligated above the tumor and divided. The submaxillary salivary gland was also removed through the same angular incision, although apparently not involved. The patient recovered from this operation without showing signs of acute cerebral softening. Some two months later I examined him, and he complained of some shooting pains in the left side of his head, and insomnia. He had had a tonsillar or peritonsillar infection, and his physician said a slough of the tonsil, for which the diminished blood-supply might partly account. He had an obstinate bronchial cough; also complained of double vision. Eye examination by Dr. Deichler: "Uveitis with atrophy of choroid and pigment deposits and exudate into vitreous." There was at this time a suspicious induration the size of a grape appearing at the upper angle of the wound. He was given the benefit of radiation, radium being used externally and by needling. Despite this treatment recurrent malignant infiltration of the superior carotid triangle was quite extensive when

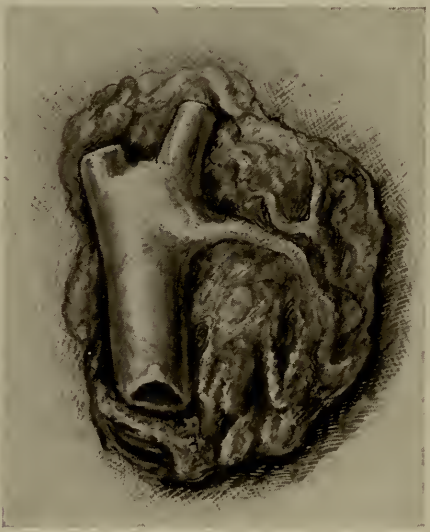

Fig. 27.—The posterior surface of the tumor with the resected carotid vessels attached. The internal jugular vein runs through the growth.

last seen, five months after operation. We learned that he died some months after this examination, but the exact date was not ascertained.

The pathologic report by Dr. Eiman is as follows: "Specimen consists of an irregular lobulated tumor mass to which is attached a piece of voluntary muscle, a piece of common carotid artery, and pieces of internal and external carotids. Internal and external carotids measure respectively 1 and 1.5 cm. Common carotid measures 2.3 cm. The tumor mass measures 5.5 x 4.7 x 3 cm. It shows no definite capsule, but is fairly sharply circumscribed. The tumor infiltrates into the adhering muscle. It cuts with increased gritty resistance, section surface slightly granular and mottled in appearance, from yellowish gray to yellow. The grayish areas are fleshy in consistence. The yellowish areas are more firm and somewhat gritty. The cut surface is not unlike the scirrhous cancers of the breast.

"Gland 5 x 2.3 x 2 cm. (submaxillary salivary gland). Capsule definite, cuts without increased resistance, cut surfaces lobulated, grayish-yellow in color, consistence firm. No evidence of neoplastic growth.

"Micro.: Squamous-cell carcinoma.

"The framework is composed of fairly dense connective tissue, which shows moderate infiltration of small round cells and plasma. There is nothing to show that this is metastatic carcinoma in the lymph-node. If primary growth of squamous-cell carcinoma anywhere in the buccal, pharyngeal, or laryngeal mucous membranes can be eliminated, this tumor may be an enclavoma springing from the rest of epithelial cells lining the branchial clefts.

"The epithelial cells occur in irregular nests and show many pearly bodies and occasionally a karyokinetic figure. No chromophil granules seen. There is no capsule. The epithelial cells infiltrate into adjacent muscle. Salivary gland shows no noteworthy lesions. The cells of some acini show some mucoid degeneration."

The growth is either a primary carcinoma of branchiogenetic origin or a metastatic growth, the primary focus not being discovered after repeated examinations. There are certain cases of metastatic carcinoma of the neck in which the primary cancer of the upper air-passages escape detection. This was emphasized in a discussion at a recent meeting of the American Surgical Association. Unfortunately, no autopsy was obtained in this case. In view of the failure to detect a primary cancer elsewhere, and the well-limited character of the growth, we were led to attempt its removal. Had it proved to be a carotid tumor, the chances of greater prolongation of life than was obtained in this case would have been good.

CLINIC OF DR. GEORGE P. MULLER

UNIVERSITY HOSPITAL

OLD DISLOCATION OF THE HIP TREATED BY OPEN INCISION

THE first patient to be shown you represents a rather rare condition extremely difficult to treat. The history is as follows:

J. M., aged thirty-five. On June 5, 1922 was injured by having a log roll over the thigh and side. Dislocation of the hip diagnosed and reduction effected under ether anesthesia. Remained in the hospital nineteen days, and then left at his own request. Remained in bed for one month, went back to the hospital, and further attempt was made to reduce the dislocation. No improvement. Came under our observation December 12, 1922, six months after the injury. Examination reveals usual deformity over a posterior dislocation of the head of the left femur, and this is confirmed by the *x*-ray (Fig. 28), which also shows a fracture of the lip of the acetabulum.

Just when an unreduced luxation of the hip may be classified as "old" is a mooted question. Some authors classify the lesion as old when closed reduction is no longer possible, but this classification is open to discussion, since some surgeons, among them Schoemaker of The Hague, have reported successful reductions many years after inception of the injury, although Sir Astley Cooper considered that after eight weeks no attempt should be made to reduce a hip dislocation.

The difficulties which must be surmounted by either open or closed reduction are: (1) The shortening of the soft parts (muscles, ligaments, nerves, and vessels); (2) the narrowing of the capsule; and (3) the filling of the acetabulum with shreds of the torn capsule and with newly formed connective tissue; (4) the fixation of the head in its false position.

Payr, Dollinger, and Buchanan are advocates of open reduction. They think that closed reduction is potentially more dangerous because the femur may be fractured, muscles, tendons, or vessels may be ruptured, with resulting hemorrhage, and because the attending shock is more severe following the rough handling which must be resorted to in the posterior method.

Open reduction is extremely difficult and is not entirely devoid of danger. In fact, anyone who thinks it is simple should pause before undertaking the procedure. At times it is impossible to reduce the luxation even after incision, and resection of the head must be done in an attempt to improve function.

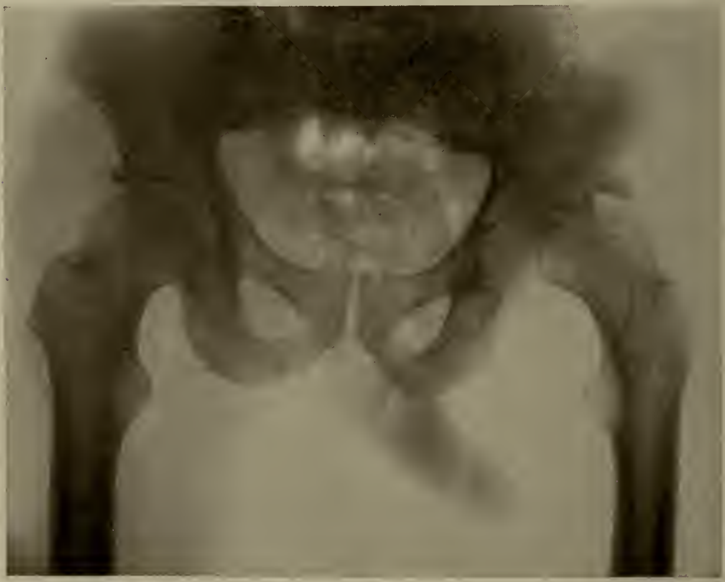

Fig. 28.—Posterior luxation of the head of the femur.

My experience is limited to 2 cases; the operation in the first case performed last year consumed four hours, and the trauma inflicted was so great that the patient died from shock. It was a very interesting case, the patient being admitted after an automobile accident in very serious condition. He had a fracture of the skull, the malar bone, and the right femur. The *x*-rays always made to determine the condition of the fractured femur never showed the dislocation, and there were no clinical symptoms of it. In January, 1922 I plated the femur, and it was not until we got him out of bed many weeks later that the extreme shortening was detected and the true condition diagnosed. Twenty weeks from the time of injury elapsed before the operation for the reduction of the dislocation was done. I approached the joint through a Kocher incision and, naturally, we were much impeded in our leverage manipulations and extension by the recent plated fracture. The acetabulum was filled flush with exudate and the attempt to skid the head of the bone into it after it was cleared consumed the time.

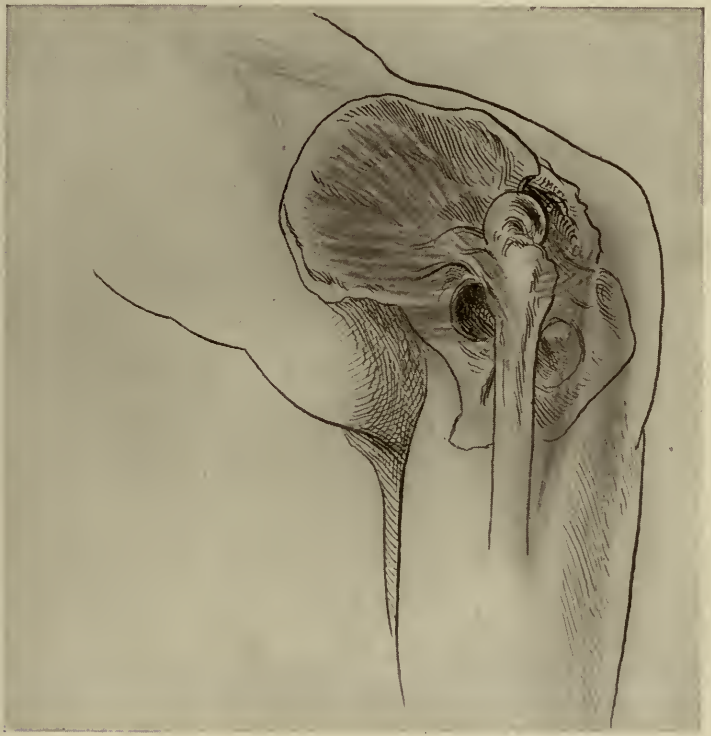

Fig. 29.—Diagram illustrating distance through which the head must pass before reduction can be accomplished.

In the ordinary case preliminary extension is of use in drawing the head of the femur down to the level of the acetabulum and in stretching ligamentous and muscular tissues. Much discussion has taken place as to the method of approach, and usually the Kocher incision has been employed, but in this patient shown to you today you will note that the incision was an oblique one, beginning above the trochanter and extending backward and upward. I simply slashed across the glutei muscles and caught my vessels as they were cut. The exposure was ideal. The acetabulum was filled up, but was easily scooped out, although I noticed that the piece of the rim of the acetabulum was not removed. In this patient leverage was easy because of the absence of fracture and we were able with but little difficulty to throw the head of the bone into the cavity after the latter

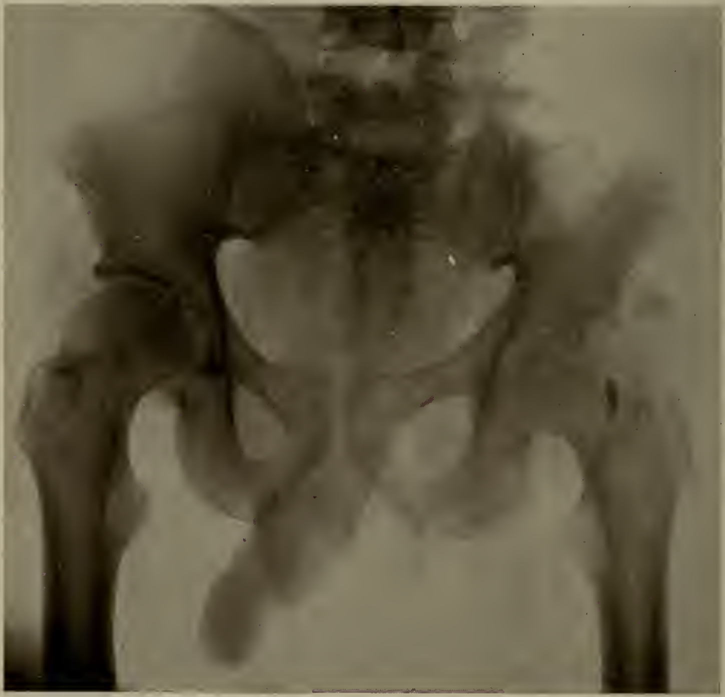

Fig. 30.—Complete reduction—*x*-ray taken just before discharge.

had been prepared. The result is eminently successful, as you will see from the *x*-ray (Fig. 30). During the operation I was so unfortunate as to break one of my knives and to be unable to find the blade after a brief search. You will notice that this appears in the picture. The wound healed by first intention and the man is now walking around eight weeks afterward. We simply placed him in a plaster cast after the open reduction.

TUBERCULOSIS OF THE HIP-JOINT

The next case presents a number of points of practical interest. He was first treated by a well-known and first class orthopedist, but for various reasons did not do well. I was obliged to take him on my service because of the desire to favor the doctor who referred him. The preliminary history of the patient is as follows:

B. S., aged seven. Three years previously he developed the classical symptoms of tuberculous coxitis and remained more or less untreated for a period of six months, at which time he was operated on for abscess. A year later a second operation was necessary. Since this time there has remained a sinus on the outer surface of the right thigh and about 2 inches below the joint. The child was sent to a seashore house at Atlantic City, but was not improved, on the contrary, he was made worse. He was admitted to my service in the Medico-Chirurgical Hospital on July 20, 1921, anemic, toxic, and evidently suffering from a severe mixed infection with acute exacerbation in the hip-joint. Yellow pus was discharging from the sinus and there was fever of 103° F. Muscular rigidity was pronounced.

The child was placed on a Bradford frame and Buck's extension applied. To my surprise, only the Staphylococcus albus was found in the pus. The *x*-ray revealed considerable destruction of the head and neck of the femur of a tuberculous character (Fig. 31). For a time we gave the child an autogenous vaccine together with old tuberculin, irrigating the sinus daily with a ½ per cent. solution of mercurochrome. On August 30th, through an anterior incision, I opened the hip-joint and very gently curetted the remains of the head and neck of the femur. The disease had extended to the acetabulum. I "débrided" the sinus and inserted four Dakin tubes through the anterior and lateral openings. The child did well. An *x*-ray report one month later reads as follows: "The broken-up and irregular moth-eaten appearance of the bone in the region of the neck and tuberosity of the right femur has practically disappeared. There now remains only a shell of bone conforming to the outline of the interior surface of the neck of the femur. The general appearance suggests a healthy reparative process. The surrounding bone is assuming a more healthful and normal density" (Fig. 32). In November, although the child made very good progress, we decided to transfuse him, and he was given 300 c.c. of citrated blood, repeated two weeks later. The result was exceedingly satisfactory in that the red cells increased from 3,000,000 to 5,050,000 and the discharge from the hip became very much less. I had an *x*-ray taken of him just before he left the hospital in the latter part of December. It showed that "the right hip-joint in comparison with a previous examination made several months ago reveals most marked and definite evidence of abun-

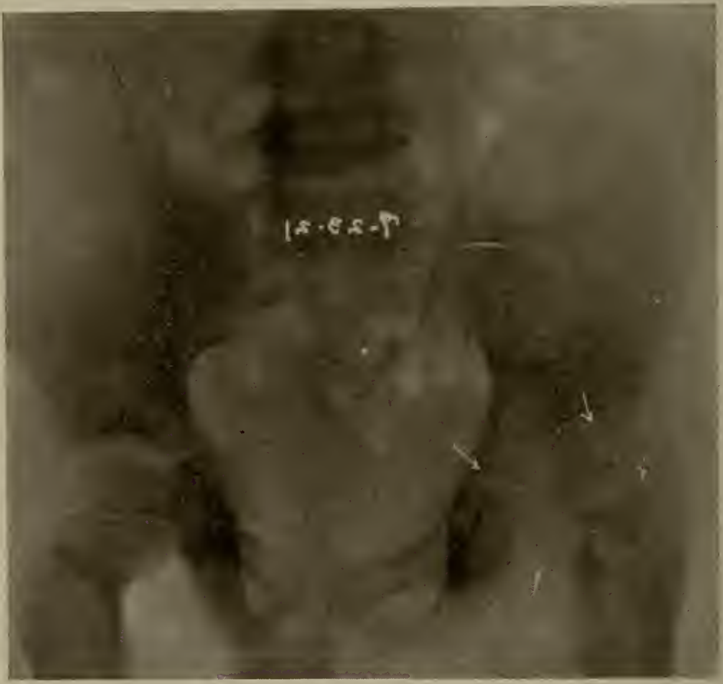

Fig. 31.—First *x*-ray showing nearly complete bony destruction.

dant bone repair. The neck of the femur shows a dense sclerosis, smooth in outline and normal in contour. The head of the femur is beginning to take on a normal aspect as to form and relation. It is quite clearly discernible. The structures about the acetabular cavity are also regenerating (Fig. 33).

You will notice that he is able to get around quite well with a brace, a high shoe, and crutches. He has 3 inches of shortening. He attends school (January 15, 1923).

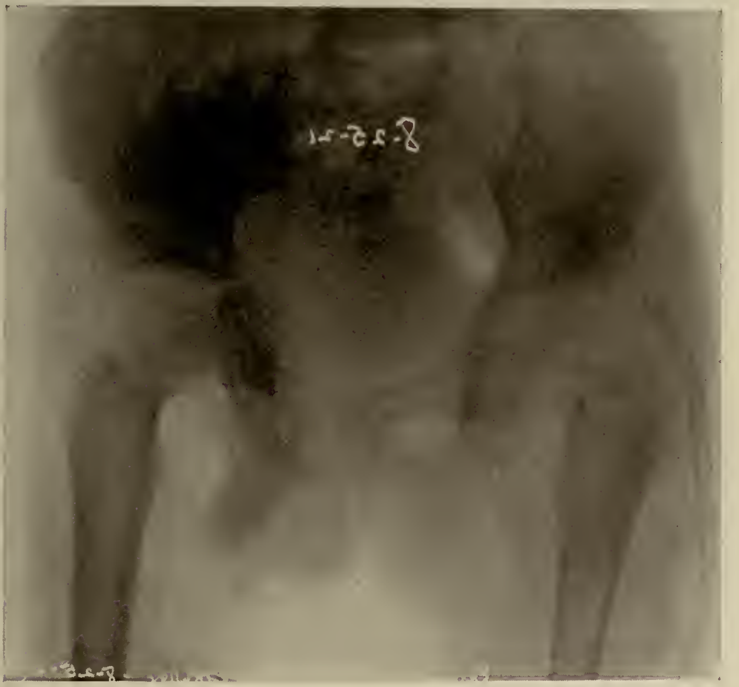

Fig. 32.—Condition one month later.

Transfusion was resorted to in an endeavor to increase the bactericidal and antitoxic properties of the blood. I feel that there is a large group of cases suffering from chronic and subacute infections which are materially benefited by transfusion. Whether or not the blood introduced stimulates the hematopoietic structures, or merely throws into the circulation functioning corpuscles is not definitely understood. The blood, however, probably contains antibodies which affect the life of the organisms causing the infection, or it may so stimulate the patients as to help them develop an active immunity. There is no doubt in my mind that transfusion has been a supporting factor in cases of this type. I do not transfuse during the stage of acute infection.

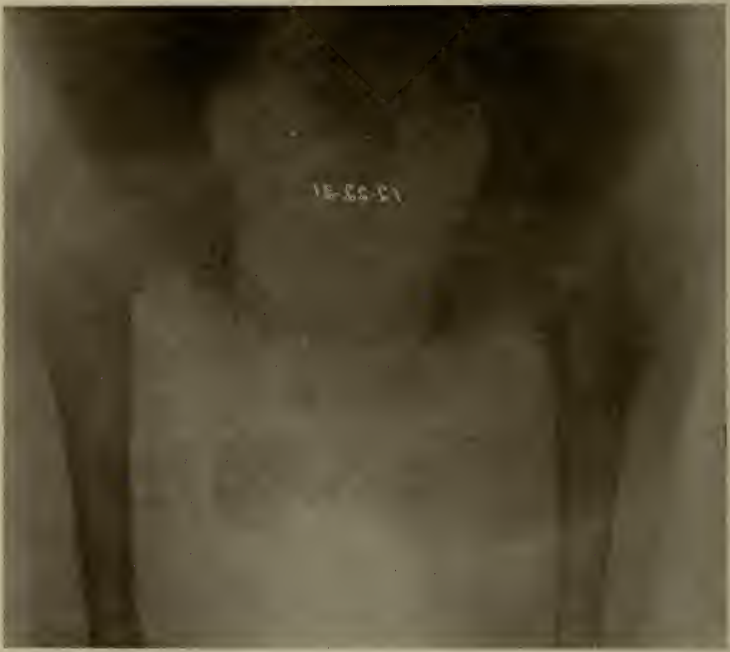

Fig. 33.—Regeneration of the head and neck of the femur.

The regeneration in this case probably occurred in part from the periosteum. It may be, as Haas has shown, that the blood-clot left behind after the curettement stimulated bone regeneration. Shede and Bier have also recognized the value of blood-clot in osseous regeneration. Since the first *x*-ray shows very little of the neck of the femur remaining, it is unlikely that the regeneration of bone is entirely dependent upon the presence of pre-existing bone.

It is very necessary in cases of this character to remove the necrotic material, but the curettement should be very conservatively done, since Todd has found the cancellous tissue one of the important factors in bone regeneration; therefore any healthy cancellous bone should be retained.

Suppuration must be controlled as early as possible. The vaccine we used, as well as the tuberculin, seemed to help somewhat, but free exit of pus from the suppurating area, incising for drainage wherever and whenever necessary, undoubtedly did the most in obtaining the successful result in this case. Most experimenters are in accord that regenerating bone is very sensitive to inefficient drainage. It should be remembered that in case of tuberculosis of the bone there is no new bone or sclerosing process thrown out around the infection, but that here we have a purely destructive osteodepressant process.

ARSPHENAMIN JAUNDICE SIMULATING BILIARY DUCT OBSTRUCTION

Jaundice, as the surgeon sees it, is almost always due to obstruction of the common duct by stone or swelling of the pancreas. Sometimes we encounter "catarrhal jaundice" so called, and sometimes we see jaundice associated with splenomegaly and with hepatic cirrhosis, etc. To these must be added arsphenamin jaundice, and it is only within the last few years that we have become familiar with this complication of the treatment of syphilis. The patient I am about to show you was seen in consultation with Dr. Rovno, and I must admit that I was suspicious of a surgical obstruction of his duct. The history is as follows:

A. W., aged forty-one. For several years has had neuritis in the left shoulder, for which he underwent all kinds of treatment at hospitals and from private physicians. Eight months ago and apparently without a positive Wassermann reaction he was given twelve intravenous injections of salvarsan, but without relief of his neuritis. Later he went to a private physician, who continued this treatment and gave him some intramuscular injections the nature of which was unknown. The neuritis was cured. He then noted jaundice was appearing, the skin and eyes turning yellow, and at the same time experienced nausea, a sense of fulness in the upper abdomen, and "heartburn," relieved by the taking of soda. The urine has been dark and the stools of a clay color. He had no itching of his skin. Physical examination on admission revealed nothing except an enlargement of the liver extending 1 inch below the costal margin and the generalized icterus. He also had protruding hemorrhoids. A few days ago I removed these in the usual way under gas anesthesia.

There is nothing else to remark about this patient except that we found a positive Wassermann reaction. There seems to be no suggestion in his previous history as to how and why he should be luetic. He has 6 children living and well, and his mother and father attained an extreme age, the latter dying at the age of eighty-two. Three brothers and 3 sisters are living and well. The important point in this case is simply the addition of another cause for jaundice and the necessity for care in not mistaking it for a surgical lesion. The increasing use of salvarsan by the general practitioner justifies the following remarks:

Jaundice of luetic origin may occur: (1) During the florid stage of the disease (syphilitic hepatitis). (2) From acute necrotic hepatitis. (3) In association with hepatic gumma, or cirrhosis. (4) After arsphenamin therapy. Jaundice associated with arsphenamin treatment may be due to: (1) The action of arsphenamin upon the spirochetes infecting the liver, or (2) it may be entirely due to arsenical poisoning of the hepatic parenchyma, with a resulting fatty degeneration.

The jaundice may occur during, after, or as late as ten or twelve weeks following treatment. Late jaundice is not infrequent and a history of previous arsphenamin treatment in jaundiced patients is extremely important. Harrison states that jaundice occurs in 0.6 per cent. of the cases of syphilis during or subsequent to treatment with arsenical preparations. Todd has observed that the jaundice occurs more frequently in the winter when the diet is high in fat and proteins. Physical examination shows hepatic enlargement in from 40 to 50 per cent. of the cases, but this tends to decrease later in the disease. Decrease in the size of the liver during the jaundice is against common duct obstruction from stone.

The disease is usually afebrile, but prodromal symptoms and a marked febrile reaction may be present. Occasionally, as in this patient, the temperature may rise to 103° or 104° F., and chills, nausea and vomiting, and epigastric pain may complicate the picture. Pruritus may be distressing, abdominal tenderness located in the epigastrium, or over the enlarged liver is usually demonstrable. Bile-pigments in the feces may be diminished, but this is not the rule, although occasionally the stools, which are usually light green in color, may be actually clay colored. The latter is more apt to occur in the severe or fatal cases, which simulate acute yellow atrophy.

The average duration of the jaundice is about four weeks, but it may persist for several months. The consensus of opinion of the more recent writers is that the pathology is probably that of a diffuse interlobular hepatitis. The persistent presence of bile in the feces except in the fatal cases simulating acute yellow atrophy, the dissociation of the biliary substances as excreted in the bile, and the slow disappearance of the jaundice are against obstruction as a cause of the icterus. Van der Burgh has been able to differentiate between jaundice from liver damage from that due to stasis, and this test will certainly assist in cases in the future where the differential diagnosis may appear difficult.

Note.—Four months after discharge from the hospital the jaundice had disappeared and the patient was entirely well. His physician has been giving him the old "mixed treatment."

ABNORMALITY OF KIDNEY PELVIS WITH PYONEPHROSIS

The diagnosis and treament of hydronephrosis and pyonephrosis is sometimes complicated by the presence of anomalies of the kidney formation. Mostly these are in the form of the horseshoe-kidney, or double ureters. An extremely interesting and curious example is seen in the following case and one which we believe is unique or nearly so in the literature of the subject.

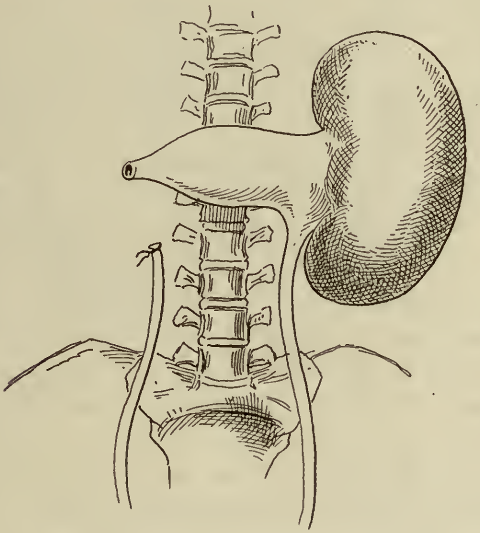

Fig. 34.—Condition found at autopsy.

The patient died recently and this is the specimen (Fig. 34). The case history is as follows:

J. K., aged twenty. Was admitted to the Medico-Chirurgical Hospital August 21, 1921, with a chief complaint of pain in the right lumbar region and hematuria. Four years ago he began to have attacks of dull pain in lumbar region, which radiated around the crest of the ilium over to the right iliac fossa. These attacks were always relieved by magnesium citrate and recurred only when patient was constipated. Last attack was five days before admission, when he had had no bowel movement for forty-eight hours. The purgative gave the usual relief, pain ceasing upon his emptying his bowels. Two days later patient was suffering no pain, but noticed large amounts of blood in his urine. He had no polyuria and no constitutional symptoms of any sort. Patient gave no history of having undergone any sort of strain or traumatism prior to onset of hematuria. He stated that he had had during the recurrent attacks of lumbar pain no general abdominal tenderness or pain, and never vomited except once, and this was caused by some medicine he had taken. Never noticed blood in stools.

Physical examination revealed nothing abnormal, no enlargement being felt over either kidney. Cystoscopic examination showed blood spurting from the right ureter; left ureter negative. No indigocarmin elimination from either kidney at seventeen minutes. A diagnosis of essential hematuria was made and the patient discharged, but he later returned with an exacerbation of the pain. On August 15, 1921 Dr. Ravdin performed a nephrostomy on the right kidney. The operation was rapidly done under gas anesthesia, and but few observations were made. The drain was inserted directly through the kidney into the pelvis. For a while he did well, and it is interesting to record that on September 23, 1921 Dr. MacKinney found a normal flow of indigo-carmin from the left ureter, but was unable to pass a catheter up the right side. I have said that he did well, but it was noted that there was still some febrile reaction. After a few weeks it was decided that he was absorbing from his right kidney and, accordingly, on October 29, 1921, I performed nephrectomy. The notes of the operation are as follows: The old scar was excised and the kidney exposed and found to be fairly adherent. The lower pole of the kidney was shaped like a tongue, resembling very closely at first a horse shoe-kidney. The kidney was freed, the pedicle ligated, and the kidney removed. The renal pouch was drained with a large rubber tube. Wound closed in the usual manner.

Although the lower end of the kidney was sickel-shaped, yet it was not connected with the other side. Two days after operation, following a temporary anuria the patient commenced to pass large quantities of urinous fluid from the wound, and for a period of seven days all of the urine was apparently voided through the right wound. We were completely mystified, hardly believing that it was possible that an anomalous condition of the ureters was side-tracking the urine. At the end of this week he commenced to void, and five days later the fistulous tract was completely closed.

This state of affairs recurred again and again, the patient having a period of apparent normality, only to be followed by suppression and fistulous discharge from the side. During an entire year he remained in practically the same condition, but at the end of that time became uremic, and was admitted to the University Hospital on Januray 4, 1923, and died the same day. At autopsy the left kidney was found to be about four times the normal size. A large cystic mass between the kidney and the vertebral column proved to be the left pelvis, which was full of pussy urine. Dissection showed that this pelvis extended posterior to the aorta and the vena cava to the right side where a fis-

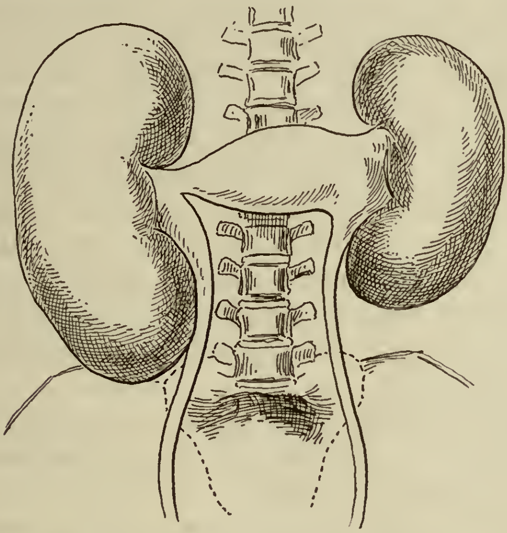

Fig. 35.—Reconstructed picture of condition present at first operation.

tulous opening communicated with the incision in the right loin. The right ureter was found and its upper end was tightly closed. The left ureter was patulous (Fig. 35).

Diagnosis.—Left-sided pyonephrosis, with communicating pelves.

It is hard to explain this case and, as I have said, we have been unable to find a similar case in the literature. Embryologically the kidney pelvis is the upper dilated portion of an outgrowth from the mesonephric (Wolffian) duct. As a result of embryologic discrepancies many renal or ureteral abnormalities may occur. In the horseshoe-kidney two renal pelves and ureters are usually present. In 300 cases of duplication of the renal pelvis and ureter collected by Mertz, 27 per cent. were bilateral. At times the fusion may be so extensive that a single renal pelvis may occur. In the cases of double ureters and pelves it seems most likely that the analagen of the kidneys have fused secondarily, *i. e.*, after the tubular outgrowth from the mesonephric duct has taken place. This later forms the ureter and pelvis.

In this case it seems that a communication between the upper dilated portions of the primitive renal pelves must have taken place when they were extending toward the ventral side of the vertebral column.

At autopsy the left kidney showed no evidence of having the slightest connection with the right one. Many abnormalities of the ureters have been described, among them, double or triple ureters or pelves, from a fused kidney or from a single kidney. The renal pelvis may be subdivided into a number of tubular calyces, or it may be cleaved into two separate compartments either alone or together, with a doubling of the ureter. The ureter may occasionally be absent and it may at times empty into the seminal vesicle, into the ejaculatory ducts, or prostatic urethra.

There can be no doubt but that renal abnormalities predispose to disease. In this case infection of the one side surely led to infection of the other. It is to be regretted that although cystoscopy and ureteral catheterization was practised, no pyelograms were made. The condition was not diagnosed antemortem because the patient refused further cystoscopic study.

SECONDARY SUTURE IN THE TREATMENT OF INFECTIONS OF THE NECK

Frequently we encounter tuberculous cervical adenitis which has broken down and become involved by mixed infection. If one dissects out the tuberculous mass and closes the wound with simple drainage we frequently have a nasty infection developed which ruins the scar and causes prolonged convalescence. In other cases there may be a simple suppurative adenitis, and here again we would like to obtain better cosmetic appearances than is usual. For this reason I have deliberately planned a wide primary excision of infected glands, either suppurative or tuberculous, followed at a later time by complete suture of the wound. In all we have had over 20 cases, but this patient will serve as an example:

A. B., aged nine. The child has had swollen glands of the neck for many months. Recently they have increased in size, become fused, and probably infected, because you notice a red bulging mass, and we have the further evidence of fever. Under ether anesthesia I made a 3-inch incision and carefully dissected a mass of infected glands from the submaxillary region, extending downward and outward under the sternomastoid muscle. Some of the glands had broken down, so that at times there was free pus in the wound. Wound was swabbed clean, the edges lifted, and it was carefully packed with iodoform gauze. One week later after treatment in a way to be described the edges of the wound were freshened and sutured together. This sutured wound healed perfectly and you will notice that the scar is small, narrow and soft, and the parent of the child is well satisfied with the result.

In these cases we have been so bothered by secondary infection, unsightly scars, and recurrence by reason of inadequate operation that it seemed worth while to change the plan. Furthermore, even in some of the clean cases it has been necessary to tap the wound several times during the healing in order to evacuate serum collections. While as yet we have not attempted the two-stage operation in such cases, I feel inclined to do so. The procedure is as follows:

At the primary operation after the incision has been made and the dissection done the skin edges around the sinus should be carefully trimmed in order to remove all devitalized skin, because this only harbors skin cocci, which may spread into the deeper tissues, and it is of no use at the secondary operation where the coaptation of healthy skin edges is essential for a good cosmetic result. As mentioned in the description of the case, the wound is packed with iodoform gauze, plain or soaked with liquid petrolatum. Sometimes, when there is much oozing, we have used packing soaked with Whitehead's varnish. Each day the packing is removed, the wound cleansed with hydrogen peroxid, dried, and repacked, except in those wounds which are sloughing to a considerable degree, in which case a Carrel tube is packed in and Dakin's solution instilled. At each packing care should be taken to continue the elevation of the skin-flaps and packing under them in order to prevent their adhesions to the deeper tissues with resulting inversion, reaction, and fixation of the edges of the wound. Sometimes, toward the end, we have used a solution of gentian violet. In other cases we have used acetic acid and alcohol. As a result of the treatment there develops a layer of loose and extremely vascular granulation tissue. Surrounding this there is a stratum of connective tissue and an area infiltrated with round cells and leukocytes. The field is therefore prepared not only by new tissue formation but also because of the added local resistance from the leukocytes, and a certain amount of general immunity which develops against the usual skin cocci.

After the wound is apparently clean it is cultured to determine the presence or absence of streptococci. If this is not done routinely certain of the wounds after the secondary operation will become red and swollen, there will be a marked elevation of the temperature, and the wound will break down. When the streptococcus is present in the wound Dakin's solution is used by the

Carrel method until a negative culture is obtained. The presence of staphylococci is no contraindication to closure by this method, nor is a microbic count, as suggested by Carrel, essential.

Usually in from five to seven days we are ready for the secondary operation.

The technic of the secondary closure is as follows: The area surrounding the wound is cleansed with ether and then painted with picric acid (5 per cent. in 95 per cent. alcohol). A cataract knife is used to pare the skin edges. This is especially necessary if more than six or eight days have elapsed following the primary operation, and the skin edges have become thin and bluish. The superficial succulent granulation tissue is then removed by dissection or curettement. It is preferable to dissect off the granulation tissue, for in curettement there is too great a danger of feeding the cocci which may be present in the superficial layers into the deeper freshly exposed surfaces of the wound.

It is of importance to be sure that the deep as well as the superficial surfaces are closely coapted. Dead spaces will fill with blood oozing from the freshly denuded surfaces and infection of the clot will probably lead to failure of the closure. I do not believe in the use of deep buried sutures of catgut to obtain subcutaneous coaptation. I feel that it invites infection and have routinely used, when necessary, deep tension sutures of silkworm-gut, which are inserted as vertical mattress-sutures and passed through rubber tubing. The intervening skin edges are then brought together by Michel clips. No drainage is practised. Rubber-dam and tubing acting as foreign bodies seem to invite infection and sepsis is apt to appear along the line of the drainage tract even though it may be removed at an early date (Fig. 36).

If the wound appears to be red and somewhat swollen at any subsequent dressing, I make it a practice to avoid probing. It is my routine to apply in these cases a warm wet compress of boric acid and glycerin. The infection, if present, can usually be taken care of in this way, and the suture line will not be demonstrably affected. It is a mistake to probe or open the wound for a mere elevation of the temperature, especially when the smear

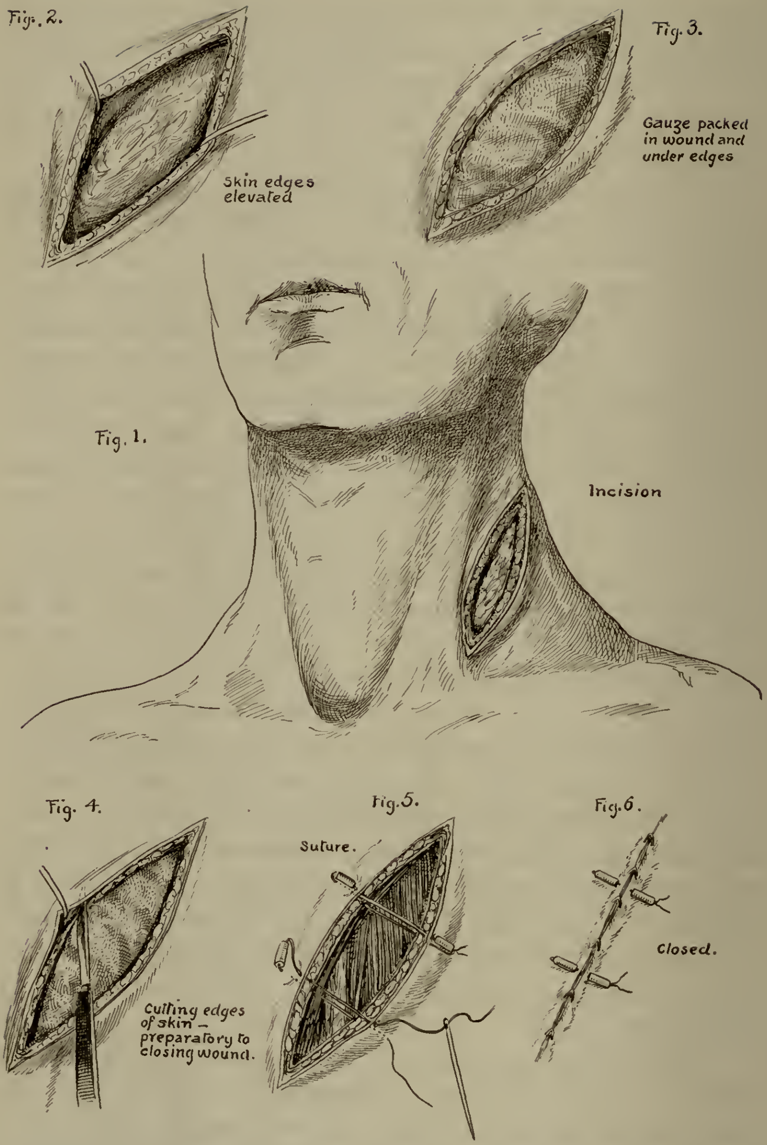
Fig. 2.
Skin edges elevated
Fig. 3.
Gauze packed in wound and under edges
Fig. 1.
Incision
Fig. 4.
Cutting edges of skin – preparatory to closing wound.
Fig. 5.
Suture.
Fig. 6.
Closed.

Fig. 36.—The steps of the operation: 1, Wound after dissection; 2, 3, edges elevated and packing in place; 4, preparation of edges for secondary suture; 5, insertion of vertical mattress sutures; 6, wound closed.

for streptococci was negative, for this does not indicate suppuration. In 2 cases which did necessitate drainage after the secondary suture I removed one or two sutures and inserted a small rubber tube, surrounding the part with wet dressings.

In the normal case all sutures and clips are removed on the fifth day. This insures a wound free from the usual suture markings which characterize cervical wounds with late removal of the sutures. Tension strips of adhesive plaster may be used to reinforce the wound edges if this is desired.

CLINIC OF DR. E. L. ELIASON

University Hospital

RUPTURED LIVER (AUTOTRANSFUSION)

This case was admitted to our Emergency Service as an "acute abdomen." The patient is a boy of thirteen years, in severe shock. His mother states that an automobile struck him, knocking him down. She does not know whether the car ran over his body or merely knocked him aside.

Condition on Admission.—Patient is in extreme shock, temperature, 96; pulse, 144; respirations, 28; pale, restless, and semiconscious. Blood-pressure is 80 systolic and no registry for diastolic. Skin is dry and cool, and mucous membranes are not markedly pallid. He is very restless and constantly asks for water. The abdomen is flat and there is a long contusion and abrasion across the left lower quadrant just above the iliac crest. There is dulness to percussion over the left lower abdomen and in the left flank. Palpation demonstrates a fine crepitant sensation.* Auscultation finds that peristalsis is decreased in frequency, but increased in magnitude. There is generalized tenderness over the entire abdomen. Blood examination: Red blood-cells, 3,100,000; white blood-cells, 12,000; hemoglobin, 62 per cent. Urinalysis shows no blood.

Tentative Diagnosis.—Internal hemorrhage from ruptured viscus. Operation was decided upon, and a donor was sought for transfusion.

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* I have noted this sign in 4 other cases of abdominal hemorrhage. It reminds one of the barely perceptible crepitation obtained over a subcutaneous clotted hematoma after one or more examinations have broken up the clot. I have never been able to obtain it twice in the same place at one examination, which may be attributed to the destruction of the early clot between intestinal coils.

Operation.—With the patient growing rapidly worse, gas anesthesia was given, and simultaneously with the abdominal incision a vein in his arm was opened, ready for the blood from the donor, who has not yet appeared. The abdomen was opened through a left rectus incision, as it was here that evidence of trauma existed. The peritoneum, which appeared blue, was opened by puncture, and the blood that virtually squirted out was collected in a flask, with sodium citrate. This citrated blood, 300 c.c., was replaced in the patient's vein, and as it was being given the pulse, which had become imperceptible at the wrist, slowly returned and could be counted at 144. A donor was finally obtained, and 200 c.c. of his blood was also given after the operation was completed.

The abdominal wound was enlarged and the clotted blood remaining was mopped out. Examination of the spleen and the upper surface of the liver found no rupture. The under surface of the liver showed a laceration, 1½ inches deep and about 3 inches long, just to the left of the spigelian lobe, which was bleeding profusely. Gauze packing was tamped into the laceration, the part coming out through the abdomen being surrounded by rubber-dam. The patient left the table in good condition and with a pulse of 120. The retransfusion and transfusion caused no untoward reaction.

The wound drained bile freely with but little or no fresh blood. On the third day the patient became very restless, vomited persistently, and the pulse mounted to 168. Urinalysis showed acetone and diacetic acid. Intravenous injection of 400 c.c. of 2½ per cent. soda bicarbonate and 5 per cent. glucose was given. The vomiting stopped immediately, the restlessness ceased, and the pulse began to drop. For the first few days the patient was very lethargic, drowsy, and showed very little interest in anything. His bowel movements were also somewhat reduced in color, but had bile-pigment in them. At no time was there any bilirubin or urobilin present in the urine.

Blood examinations for the week following were as follows: Red blood-cells, 3,810,000; white blood-cells, 20,700; Hb., 65 per cent. the day following operation; red blood-cells, 4,170,000;

white blood-cells, 18,000; Hb., 62 per cent. the third day, and red blood-cells, 3,610,000; white blood-cells, 9000; Hb., 56 per cent. the fifth day; red blood-cells, 4,090,000; white blood-cells, 14,600; Hb., 62 per cent. on the eighth day.

On the tenth day after operation the final packing was removed, and on the thirteenth day all bile drainage had ceased. On the fifteenth day the patient began having severe pain in abdomen and became distended. In a short time there was a profuse discharge from the wound of a clear limpid fluid and the abdominal pain ceased. This clear fluid drainage continued for one week. Examination showed no organisms and no digestive ferments in the drainage. Three weeks after operation the wound had closed and the patient was discharged to report at "follow-up" date.

Result.—Patient was readmitted two weeks later for pain in right iliac fossa. This, however, cleared up after a few hours, and the patient is now well.

In the title of this report the term "autotransfusion" is used. The question arises as to whether we should not use "reinfusion" or "retransfusion." It is, however, of little moment, except for the establishment of unity in the literature.

Grant[1] reported a case of autotransfusion where the patient, a very plethoric individual, was bled, and this citrated blood used twenty-four hours later following an operation, that caused great loss of blood.

Lee[2] reports a few cases of his own and of other surgeons, of intra-abdominal hemorrhage, in which retransfusion was used.

Schweister[3] reports 21 cases of ectopic pregnancy, with hemorrhage, in which reinfusion was performed.

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DOUBLE KIDNEY WITH SUSPECTED CALCULI IN BOTH PELVES

The patient we are to operate upon this morning came to us four weeks ago with the diagnosis of "chronic appendicitis." The findings that were made during our routine examination of so-called chronic appendicitis cases are of sufficient interest and importance to report in some detail.

Case No. 527, N. S. S. B., aged thirty-eight years. C. C. Pain in the right lower abdomen. He gives the history that for the past twelve years he has had recurrent attacks of severe pain in the right side of the abdomen, starting as a generalized ache and later localizing low down in the right lower abdomen. He has had six to eight attacks in all. The attacks usually last from three to four days and often require morphin. The pain does not radiate and is not associated with fever, nausea, or vomiting. In at least two attacks the pain has been so severe that it caused him to writhe and break into a profuse cold sweat. There never has been any associated urinary symptoms or any digestive disturbances.

Physical examination shows nothing bearing upon his condition until we reach the right lower quadrant of his abdomen. Here, directly over McBurney's point, definite and decided tenderness is found on deep palpation.

Urinalysis.—Amber, 1025, and faint trace of albumin, no sugar, no casts, no erythrocytes, an occasional leukocyte, and a few crystals.

The blood showed 7400 white blood-cells. Blood-pressure is 130/80.

Tentative Diagnosis.—Interval appendicitis (chronic).

Further examination by the *x*-ray shows three suspicious shadows in the region of the right renal pelvis and another low down near the lower end of the ureter (Fig. 37).

Cystoscopic examination showed two ureteral orifices on the

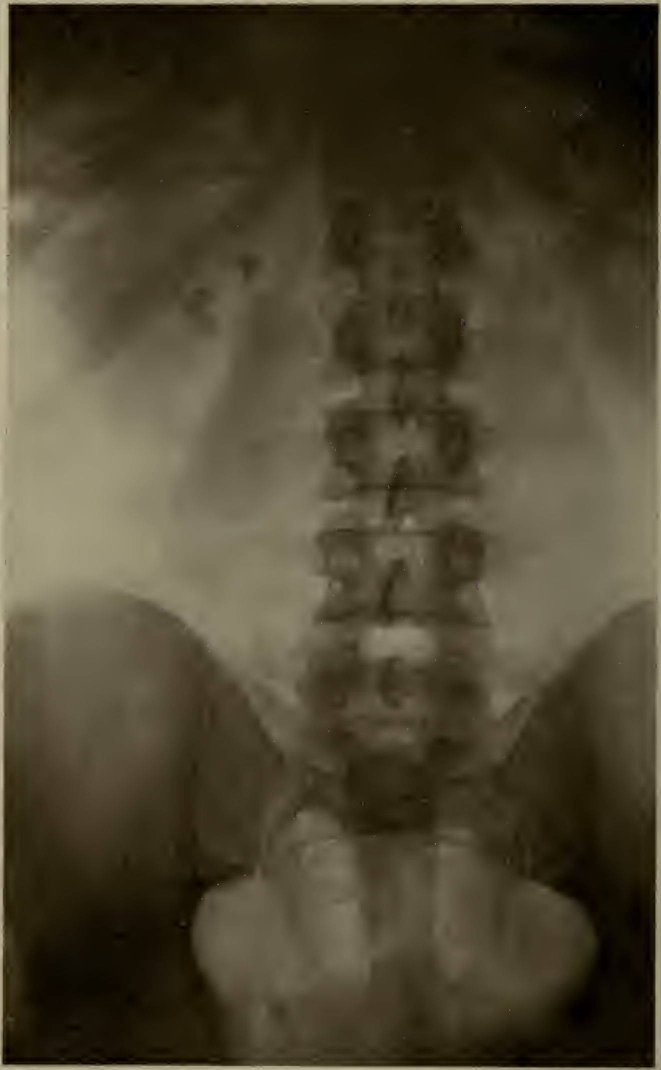

Fig. 37.—(Case 527, N. S.) Shadows of suspected urinary calculi in the pelvis of the kidney and at the lower ureteral orifice.

right, both functioning. Catheters were passed up both these ureters, and clear urine was withdrawn.

As the patient had had all the exposure to the *x*-ray that was deemed advisable, he was allowed to go home, to return after three weeks.

On readmission, a pyelogram (Fig. 38) was done, and it was found that the upper three shadows were obliterated by the sodium bromid injected into the two pelves through the double ureters. The lower shadow was found to be situated at a dis-

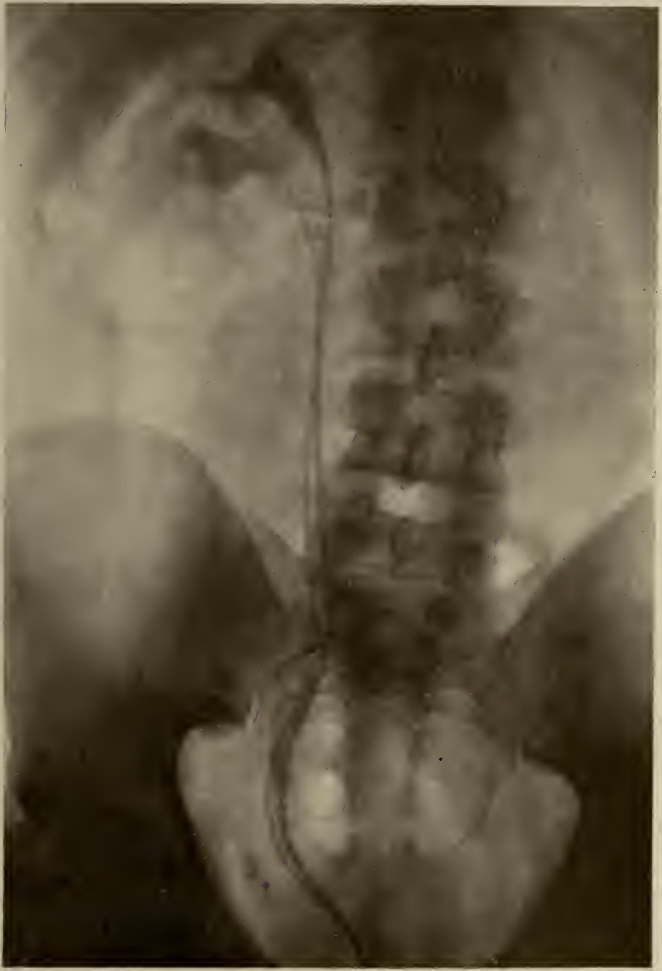

Fig. 38.—(Case 527, N. S.) Pyelogram with opaque catheter inserted into both pelvis of a double kidney.

tance from both ureteral lines. The roentgenologist was not satisfied that the shadows were in the pelves of the kidney, and asked to take another view without the injection. This was done, and the original three shadows were present. This seemed sufficient evidence that the shadows were "very probably," to quote the roentgenologist, cast by renal calculi, although, as he stated, "he could not definitely place the upper shadow within the kidney shadow."

Anticipating the possibility of being compelled to remove the kidney in question, the renal function was next taken with intramuscular injection of phenolsulphonephthalein. The left kidney secretion appeared in four minutes, with a total of 25 per cent. in half an hour, and the right kidney showed 23 per cent. total in half an hour, further evidence that the kidneys were functioning equally well.

Preoperative Diagnosis.—(1) Calculi in a double right kidney. (2) Possible chronic appendicitis.

With these findings we think we are justified in exploring the right kidney.

The patient is placed in the left lateral position, with a sandbag beneath the left loin. He does not take the gas-oxygen anesthesia well; in fact, the anesthetist cannot get him sufficiently anesthetized. We therefore change to ether. As I have told you before, we frequently have this trouble with these big, heavy, thick-necked, florid young adults.

We now make a long oblique incision, as I find we will need room, because, as you see, the space between the last rib and the iliac crest is very small. As the incision is deepened we cut, in turn, the latissimus dorsi, serratus posticus, external oblique, internal oblique, and transversalis muscles. The transversalis is split, care being taken not to wound the peritoneum. The perirenal fat is cut and torn through, and it is with difficulty that the lower pole of a very high-placed kidney is reached. The space between the twelfth rib and the iliac crest is too small for the hand. We therefore free the last rib of its muscular attachments, being careful to avoid possible injury to the pleura; with the bone-cutting forceps we remove about 3 inches of the rib. I find it somewhat awkward working behind the patient now, so I change places with my assistant. From this position it is much easier to insert the entire hand into the wound.

As the organ is gradually freed from its bed, a nodule is felt on the anterior aspect of the hilum. This feels about the size and shape of one of the shadows. I cannot as yet determine if it be within the kidney or not; on freeing the posterior surface of the kidney and palpating the pelvis I can feel no calculi. By gentle coaxing we now have the organ in view, and can note a moderately large kidney with the evidence of fetal lobulations

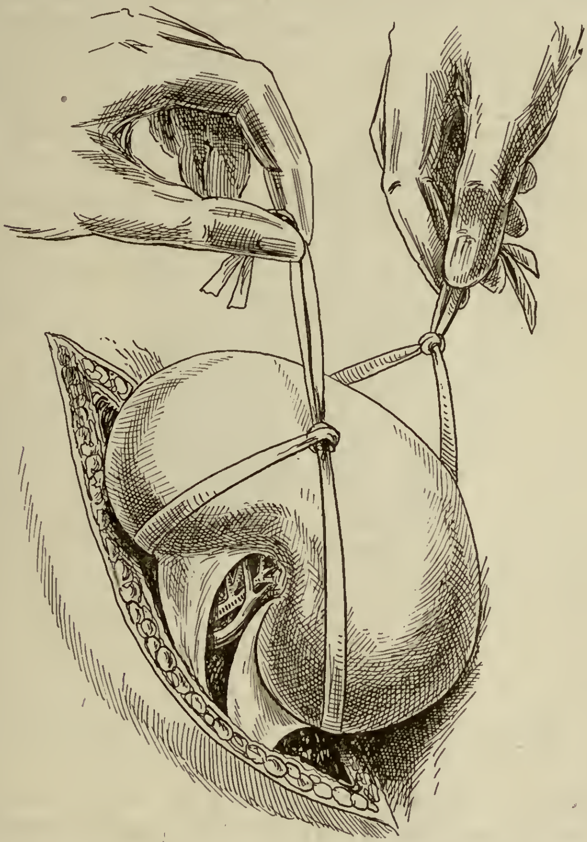

Fig. 39.—Sling support for the kidney to facilitate its delivery into the wound.

still visible. It is still impossible to bring the kidney out of its wound far enough to view the pelves because there is not room for the hand and kidney both to come through the space between the fourth rib and the iliac crest. We therefore make two slings with two strips of packing, and easily deliver and hold the kidney in position (Fig. 39). Now, by gentle dissection, we push back the fat from the posterior surface of the hilum. This allows my finger to palpate well up on the posterior surface of the pelves, which, as you now see, are two in number. I find nothing suggestive of stone. The nodule felt before the delivery of the kidney I find is in the perirenal fat and is probably a calcified lymph-node, although I cannot visualize it.

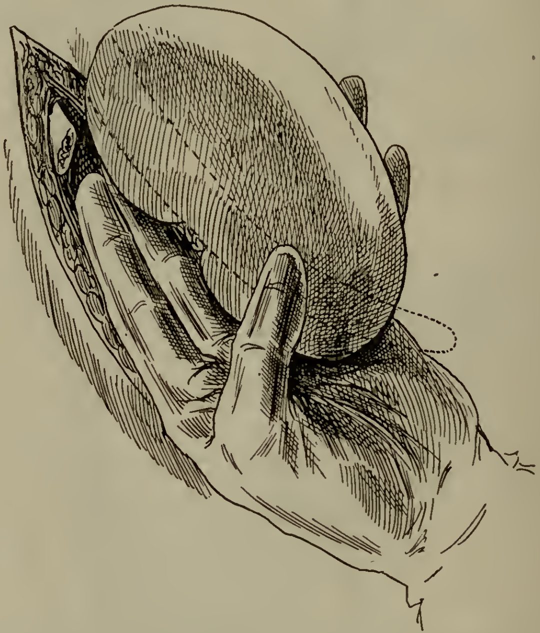

Fig. 40.—Method of hemostasis in nephrotomy cases.

Not finding the suspected stones in the pelves, we next search the kidney by piercing it in various directions with a small round-pointed needle. Still unsuccessful, and in view of the very good *x*-ray evidence, it seems justifiable to open the kidney to see if possibly the stone might be hidden therein.

In order to control the hemorrhage we now pass the left index- and middle fingers under the kidney and behind the vessels, while the ring and little fingers pass in front of the vessels and lie against the eleventh rib (Fig. 40). We select Brödel's line and make a small incision, thus testing out my finger hemostasis, which is found satisfactory. The kidney is now opened almost to both poles, and because of the finger compression against the eleventh rib there is practically no hemorrhage. Exploration of the opened pelves with the finger finds no stones, and a catheter passes down both ureters without obstruction. We now sew the kidney with a round-pointed curved needle threaded with catgut. We use interrupted sutures which completely control the bleeding. The kidney is now replaced and a split tube drain placed along its posterior border.

We still have to find the pathology in this case, and as the patient was tender over the appendix, we now turn the patient slightly backward, and expose a badly diseased appendix by opening the peritoneum at the lower angle of the wound. This is surely the cause of this patient's trouble. As you see, it is bound back upon itself as well as to the cecum with adhesions, and shows a distinct and definite stricture. I remove the appendix in the usual manner and close the peritoneum. To guard against any possible leakage from the kidney reaching the peritoneal suture line a Mikulicz drain is placed just above the peritoneal suture between it and the kidney above.

The patient is not taking his ether well. He is cyanotic and full of mucus. The anesthetist reports his pulse as 160 and weaker. His skin is leaky despite his having had 1/50 gr. of atropin.

Comment.—As we look back on this case we naturally ask where our diagnostic reasoning was at fault. The history was that of renal colic, the *x*-ray seemed to show three shadows in the pelves, although the roentgenologist was not at all sure whether the shadows were caused by calculi or calcified lymph-nodes. The three points against a calculus diagnosis were the absolutely clean urine, the constant tender spot at McBurney's point, and, lastly, the proof that the shadow down in the patient's pelvis near the bladder was outside the ureter, probably being a calcified lymph-node.

The patient reacted well and his pulse dropped to 110 in three hours. The second day he developed a bronchopneumonia and, because of his extremely poor condition on the sixth day, at the family's express request he was transfused. Both the patient and the donor, a brother, were Group II. They were also cross agglutinated, and were again found compatible. He had a mild anaphylactic reaction, from which he recovered. Three hours later he had a generalized convulsion, became unconscious, developed hemiplegia, and died.

Double kidney is not a rare condition. Braasch and Schall report 144 patients with duplication of the renal pelvis and ureter observed at the Mayo Clinic. Of this number, only 36 had complete unilateral duplication. They state that duplication is the most common anomaly in the urinary tract, and is, of course, only of importance when pathologic or surgical conditions become associated, as they are prone to do.

HYDRONEPHROSIS

THE patient for operation consulted her physician some two weeks ago for persistent headaches, associated with backache and pain in her right iliac fossa. She stated that she was operated upon three years before for "pelvic trouble" and chronic appendicitis, these supposedly causing her symptoms. At this time she had an ovarian cyst and the appendix removed.

Past Illness.—About four weeks ago the severity of her backache and headache, coupled with pain over her gall-bladder region, led her to seek the advice of another physician, who diagnosed her condition as one of gall-bladder disease. She has had no digestive symptoms. Her feet and legs swell at times.

Condition on Admission.—Patient is a pale, undernourished female, with rather a flat chest and prominent abdomen. She is slightly puffy under her eyes. Examination of the heart finds a mitral murmur. The abdomen is soft, flaccid, and there is some diastasis of the recti. In the upper right quadrant there is a large mass, corresponding to the gall-bladder site. It is smooth, firm, dull on percussion, rather freely movable in an upward direction, and can be felt in the right loin. It is not connected with the liver, as shown by the fact that it is little influenced by respiration, and the examining hand can be passed above the tumor, between it and the liver. It gives the impression of being about the size of a large orange. Both legs are slightly edematous.

On admission temperature was 98.4° F.; pulse, 100; respirations, 20; blood-pressure, 170/95.

Urinalysis shows specific gravity 1007, trace of albumin, many hyaline and granular casts.

Tentative Diagnosis.—(1) Nephrosis. (2) Hydrops of gall-bladder with an associated nephritis.

Cystoscopic Examination.—Bladder normal, indigocarmin appeared from left ureter in five and one-half minutes, but did not show from the right ureter for forty-five minutes. A second cystoscopic examination confirmed the above, with the additional findings that a No. 5 catheter could be passed up the right ureter for 20 cm., where it became blocked. No urine escaped through this ureter or catheter.

x-Ray Examination.—Outline of right kidney is not clear. There seems to be a mass larger than a normal kidney; opaque catheter in right ureter reaches to upper border of fifth lumbar vertebra.

Kidney function shows phenolsulphonephthalein elimination for first hour, 30 per cent.; second hour, 25 per cent. Blood nitrogen, 22.416.

Diagnosis.—Hydronephrosis, due to a ureteral kink or aberrant blood-vessel, based on obstruction, in the absence of x-ray evidence of calculus (not always conclusive) and the absence of renal colic.

Operation.—Under gas-oxygen anesthesia the patient is placed on the unaffected side, with a sand-bag under the loin, and the right thigh and leg flexed, the assistant pressing against the knee with his abdomen. This prevents the patient from rolling away from the operator. Because of the size of the kidney it is decided to employ the oblique lumbar incision, as it admits of enlargement over the short ribs or down inside the iliac spine. The incision is begun between the twelfth rib and the erector spinæ muscle, about $\frac{3}{4}$ inch below the rib, and is carried down obliquely toward the anterior superior spine, cutting through the skin and fascia, the latissimus dorsi, serratus posticus inferior, and farther down, the external oblique. The internal oblique is now cut across its fibers, and its fascia lumborum split. The transversalis fascia now presents. This is slit well up in the wound, being careful of the last dorsal nerve, and the two fingers of the left hand are inserted in the incision and gradually slid under the fascia in the direction of the wound, the scalpel at the same time dividing the fascia. The interposed fingers prevent peritoneal injury.

The large cystic mass is now delivered into the wound. This is found to be a greatly distended kidney. As the lower pole is raised we find a band stretching across toward the spine. This is an aberrant artery from the aorta that crosses in front of the ureter, about 2 inches below the kidney stalk (Fig. 41). Above this artery the ureter and kidney pelvis are enormously dilated; in fact, we may say they gradually expand into the enlarged kidney. Below, where the artery crosses it, the ureter is normal in size and appearance.

The vessels are clamped with two curved clamps $\frac{1}{2}$ inch apart and doubly ligated with catgut proximal to the clamps. The pedicle is now severed near the distal clamp. The proximal clamp is slowly released, thus preventing any possible slipping of the ligature. Were this pedicle a broad one it would be preferable to transfix through a space between the vessels and tie both ways. The ureter is ligated, severed, and the stump touched with carbolic acid. A split-tube drain is placed down to the pedicle, the sand-bag removed, and the wound closed in layers, care being taken not to include in the stiches the dorsal nerve seen lying along the upper wound edge.

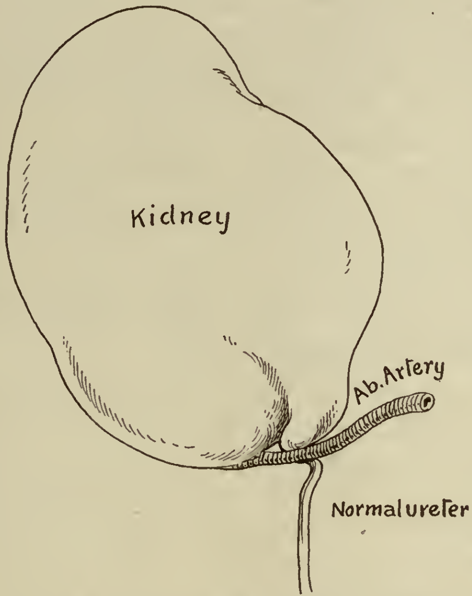

Fig. 41.—Illustrating the relations of the hydronephrosis and the artery causing the condition.

The lesson we must carry away as a result of the study of this case is an important one, namely, that backache and discomfort in the right iliac fossa are not always due to pelvic conditions, or appendicitis, nor is a mass felt in the gall-bladder region necessarily an enlarged gall-bladder. Had this woman been properly studied by her previous medical advisers she would have been saved much suffering and a needless laparotomy. The diagnosis of chronic appendicitis, causing symptoms requiring surgical intervention, should be made by elimination. Our experience in this clinic is that before a chronic appendicitis exists a previous acute condition must have occurred, and unless such a history can be elicited, an appendectomy will not necessarily cure the patient.

Convalescence.—Other than a slight infection in the wound, the postoperative course was uneventful and the patient left the hospital in four weeks.

Follow-up Report.—Patient states three months later that she is enjoying perfect health and has had no headaches or backaches since her operation.

DUODENAL ULCER, EPIGASTRIC HERNIA, RETROPERITONEAL APPENDIX, ADVENTITIOUS BAND

The patient for operation today is an adult male aged forty-eight, who comes to us complaining of epigastric pain, nausea, and constipation.

Past Illness.—Ten years ago he developed an epigastric hernia, since which time he has had frequent attacks of pain and soreness in this region. During the past two months the attacks have become continuous. He now has pain after meals, nausea, belching of gas, and hunger-pain.

Physicial examination shows nothing of importance as far as his general condition is concerned until we reach the abdomen. Here we find tenderness and rigidity of the rectus muscle in the upper right quadrant. There is also some tenderness over McBurney's point. The abdomen is somewhat distended.

Tentative Diagnosis.—Duodenal ulcer, epigastric hernia.

***x*-Ray Report.**—Duodenal ulcer, with marked gastric retention, chronic appendicitis, and no evidence of cholelithiasis.

Operation.—With the patient under gas-oxygen anesthesia, we now make a right rectus incision about 1½ inches from the midline. We come down at once upon the pylorus, which is low lying. The duodenum is very much injected, and palpation shows marked induration for a distance of 2 inches along the upper border. In the center of this induration, about 1 inch from the pylorus, the crater of an ulcer can be felt. The indurated condition of the tissues does not permit of excision, nor a Horsley pyloroplasty, nor, much less, a pylorectomy. We must, therefore, institute stomach drainage by means of a gastrojejunostomy. Before doing this we visualize, by retraction, the ileocecal region, with a view to removing the appendix. We now encounter a most interesting condition. The appendix cannot be seen, being completely retroperitoneal, lying between the leaves of the ascending mesocolon. The last 5 inches of the ileum, with the exception of the inch proximal to the cecum, is also bound down by the enveloping peritoneum to the posterior abdominal wall. This apparent retroperitoneal position terminates over the brim of the true pelvis. There is a pronounced retroperitoneal fossa behind each extremity of this bound-down ileum, and a finger can be passed into one fossa through a post-ileal canal and out the other fossa. Four or more inches of the gut is so bound down (Fig. 42).

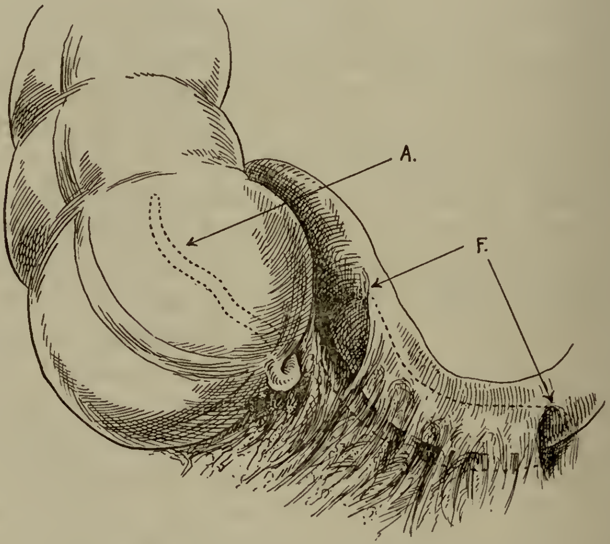

Fig. 42.—The condition found in the right iliac fossa: *A*, Retrocecal appendix; *F*, adventitious band binding the ileum well down in the pelvis, causing a very pronounced line kink.

The ileum so imprisoned is small, while the proximal free ileum is thickened, somewhat hypertrophied, and shows enough obstruction to account for the constipation complained of by the patient. We now divide the peritoneal band and free the ileum, which is rotated on its long axis, and as this rotation is corrected the gut is seen to distend. We now notice that the liberated gut has not been truly retroperitoneal, as shown by the fact that we now see that it and its mesentery, which is a very short one, each have peritoneal coverings on their posterior surface. On close scrutiny, however, we see that this peritoneum is thinner, more delicate, more transparent, and envelops the mesenteric vessels more closely than elsewhere along the ileum. In other words, we have a peritoneal lined canal or open fossa behind the ileum. These bands are frequently found in the course of abdominal operations, especially in women. It is our practice to cut them if the proximal gut is hypertrophied or the patient has symptoms referable to them.

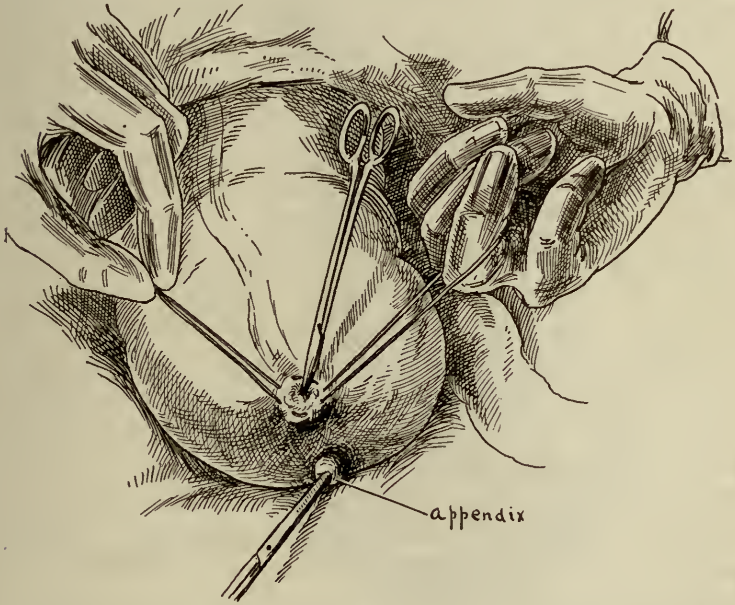

Fig. 43.—Retrograde removal of the appendix. The base of the appendix is doubly ligated and severed by cautery between the ligatures. The stump is now invaginated by a purse-string suture.

The appendix is now freed at the base, double clamped, and severed with cautery. The stump is ligated, purse-stringed, and invaginated (Fig. 43). The appendix is now removed subperitoneally by scoring the peritoneum and stripping the appendix out of its bed, clamping the arterial branches as they enter the appendix. This procedure is one we often use in subacute or chronic cases where the appendix is much swollen, indurated, and bound to surrounding structures low down in the pelvis or behind the ileum without abscess formation. By this retrograde subperitoneal removal there is practically no danger of injury to other structures and there is decidedly less hemorrhage (Fig. 44).

Those of you who are near can see exposed through the peritoneal wound the iliac vessels and ureter. A catgut suture draws the loose peritoneal edges together laterally to cover the area denuded by the mobilization of the ileum.

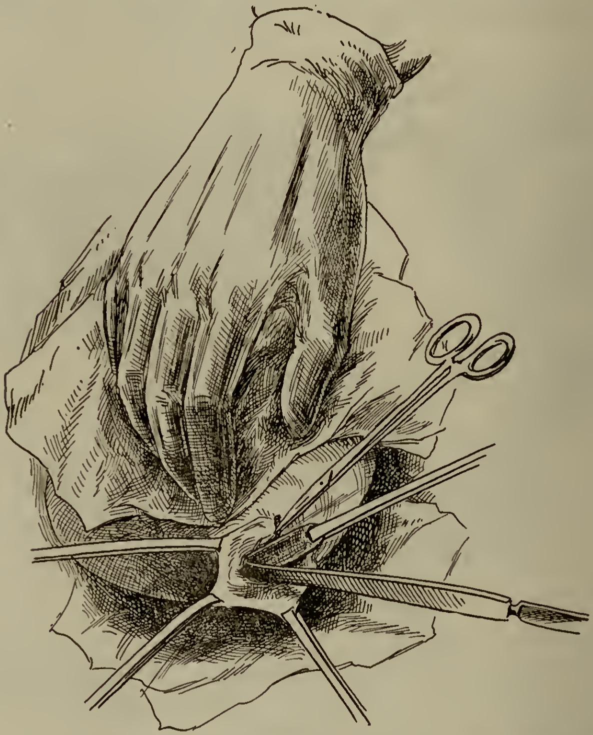

Fig. 44.—The appendix is being stripped out of its serous covering. The arterial branches are caught as they enter the appendix.

A posterior gastrojejunostomy is next performed, using absorbable gut throughout, making a short loop and being careful to have the stoma in the jejunum opposite its mesenteric border. We are using a Bartlett clamp, as we feel that we can get a more delicate adjustment and consequently less trauma to tissues with the thumb-screws than is possible with the other types of blade clamps. After approximating the stomach and jejunum sufficiently to allow a 3-inch suture line the posterior suture line is made with a curved needle. We now open the stomach and jejunum in parallel lines extending to within $\frac{1}{4}$ inch of the extent of the first suture line. The leaking contents being sponged out and the redundant jejunal mucous membrane being pared off, we start the through-and-through suture in the center of the posterior cut edges. This suture, threaded with a needle on both ends, takes in all the coats of the viscera, and each end is carried around an angle of the gastro-enterostomy, being careful to lock or backstitch every third or fourth stitch. After the two ends have rounded the angles of the incision they approach each other and are tied in the center of the anterior suture line. This makes a much better and safer angle suture, since there is not the danger of missing the wound edges as there is when one endeavors to complete the stitch and tie it at the angle. We now discard all soiled protective sponges, change the gloves, mop off the exposed viscera with warm salt solution, and complete the first or outer suture line. The mesocolon is next stitched by three or four interrupted catgut sutures to the stomach along the anastomosis line and the whole returned to the abdomen. Attention is next directed to the epigastric hernia. Some writers state that epigastric hernias are so frequently associated with gastric disease that at the time of their repair the abdomen should be opened. This seems a little radical, this being the only case in a series of 6 seen by the writer in which the patient clearly had gastric symptoms. In turning back the inner flap of the abdominal wound we notice a dimple in its peritoneum at the hernial site. This can be readily smoothed out, although the hernial prominence still exists. In other words, this is the type of hernia described by Moschowitz, which is really not a hernia, having no peritoneal covering. The skin and subcutaneous tissue is dissected back, the mass exposed, and found to be a fascia-covered mass of preperitoneal fat. This is reduced, a vessel which comes through the small orifice is ligated, and the opening is closed with a mattress-suture, overlapping the edges after the manner of a Mayo repair of an umbilical hernia.

Postoperative Course.—The patient had a smooth recovery from the anesthetic. He was placed on our routine postoperative treatment as follows: Fowler position, morphin p. r. n. if restless or suffering; nothing by mouth for six hours, then increasing amounts of water, followed by liquid diet, milk excluded, after twenty-four hours. Proctoclysis by the drip method is given. The first pint is of tap-water containing f ʒij of tincture of digitalis, the second pint is 2½ per cent. of soda bicarbonate solution, and the third is 2½ soda bicarbonate and 5 per cent. glucose solution. If there is difficulty in voiding, as there was in this case, the patient is allowed to sit on the side of the bed or even allowed to stand up, if the operation is one without drainage. The bowels are moved by an enema after seventy-two hours. I may say that we have been following this routine for six months in all abdominal cases, including peritonitis and intestinal obstruction, and there has been a remarkable freedom from distention. These duodenal ulcer cases are all placed upon a modified Sippy diet during their convalescence.

Follow-up Report.—Patient states that his health is fine, that his digestion gives no symptoms, and constipation no longer exists.

Discussion.—The formation of these adventitious bands is best explained by Hertzler, from whom I beg to quote[1]: "The older writers believed that when an organ had a mesentery and lost it, it did so because the two layers, of which the mesentery was supposed to be formed, spread out (Fig. 45, *a*). Toldt has shown that what actually occurs is a fusion of one surface of the mesentery with the parietal wall (Fig. 45, *b*). The sketch explains just why in some cases, after freeing the band at *a* we find a membrane still covering the mesenteric vessels, whereas in the *a′* cases these vessels are uncovered." Hertzler further states that "it is a mistake to speak of fusion of layers of peritoneum in the early period of developement. The truth is that what represents the mesentery is but a mesenchymal mass. At the time of fusion these tissues are covered by a layer of embryonal tissue only slightly resembling adult peritoneum. The power of such tissue to fuse with like surfaces is much greater than in fully formed tissue." It would seem that Fig. 45, *a′* illustrates the findings in this patient.

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[1] The Peritoneum, vol. i, by Arthur E. Hertzler.

So-called adventitious membranes in the abdomen are still under much discussion with reference to their etiology. There are many arguments to support the embryonal or development origin, and yet there are also some irrefutable facts that point to their development beginning after birth. The case reported below would indicate other than development etiology:

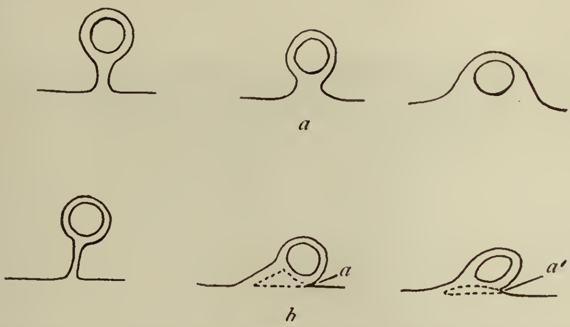


Fig. 45.—After Hertzler. The lower central drawing illustrates what was probably the condition in this case.

Case No. 68,753. Referred from the Medical Division, U. of Pa. Hospital. W. C., aged nineteen, with tentative diagnosis of subacute appendicitis. Operation through a gridiron incision; a subacutely diseased appendix was removed. Following the routine examination of the abdomen the ileum was found bound to the posterior abdominal wall about 3 feet from the ileocecal valve. The band restraining it was about 2 inches wide and merged smoothly with the posterior peritoneum, giving the impression that the ileum was retroperitoneal. On incising this band the ileum was found to be rotated on its long axis. As it rolled out into its normal position a diverticulum (Meckel's?) presented. This was about 1½ inches long, was opposite the mesentery, and had its own distinct blood-supply. The microscopic report showed the full number of normal intestinal coats.

If this was a Meckel's diverticulum it is evident its post-ileum position must have occurred after birth and been caused by inflammatory adhesions.

ESOPHAGEAL DIVERTICULUM (CERVICAL)

The case before us for consideration today has been referred by Dr. Joseph Sailer from the Medical Service and Dr. Chevalier Jackson from the Esophagoscopic Service. It has been decided that surgical intervention is indicated. The patient is in such good condition that a preliminary gastrostomy is not required. The case is one of cervical esophageal diverticulum, situated opposite the cricoid cartilage (Figs. 46, 47).

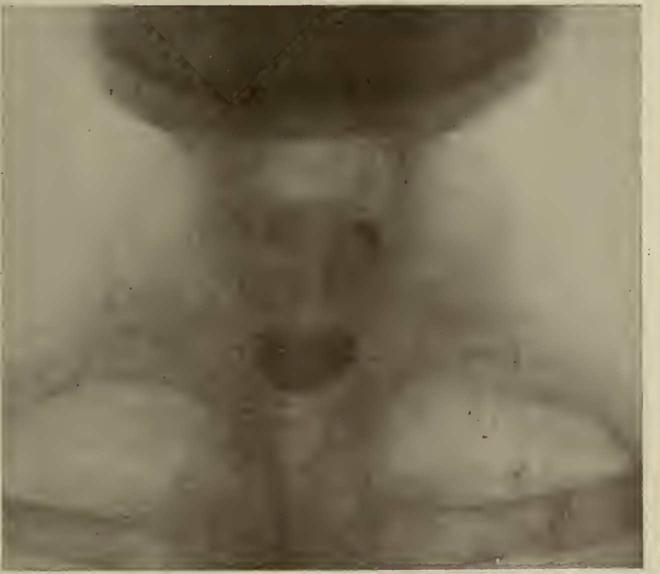


Fig. 46.—Anteroposterior view of the diverticulum with the barium content.

Operation.—Under gas-ether anesthesia an incision is made on the left side of the neck along the anterior border of the sternocleidomastoid muscle, extending from just above the sternum to ½ inch above the thyroid cartilage.

The incision is usually best on the left side, as the esophagus soon takes direction toward the left. In this case, moreover, the bismuth shadow seems to show the diverticulum also a little to the left. The severed veins are doubly ligated. The fascia is incised along the anterior border of the sternocleidomastoid muscle and it is retracted outward. After splitting the middle fascial layer the omohyoid muscle above is retracted upward and outward, and the sternothyroid and sternohyoid muscles are retracted inward. Blunt dissection separates these muscles the full length of the skin incision. This exposes the thyroid gland on the tracheal or inner side, and the great vessels are easily felt on the outer aspect of the wound. The thyroid gland is drawn inward and its fascial covering incised, well back, and in the line of the trachea, care being taken not to injure the recurrent laryngeal nerve which lies in the sulcus between the trachea and esophagus. The inferior thyroid artery now presents about the center of the wound. It is doubly ligated. Retraction and blunt dissection carries us down to the prevertebral fascia. As the trachea and esophagus with the laryngeal nerve lying in the

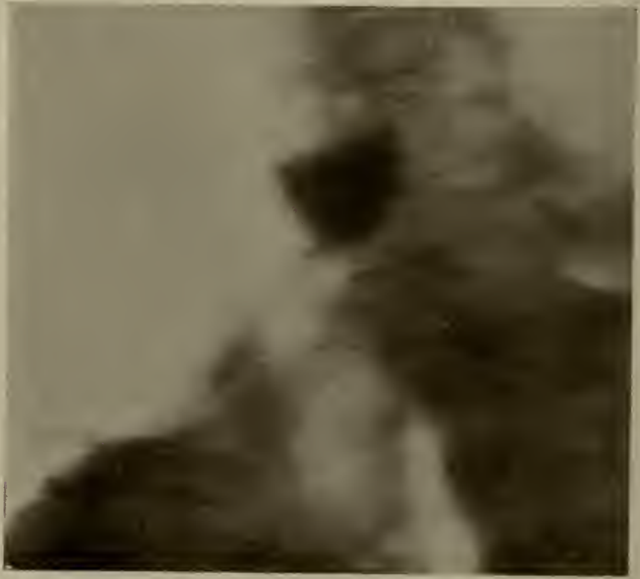


Fig. 47.—Lateral view of the diverticulum with the barium content.

groove between them are retracted inward (Fig. 48), the edge of what we take to be the diverticulum presents to view.

At this stage rather than hunt for the sac blindly Dr. Tucker passes the esophagoscope, and with the light turned on inserts

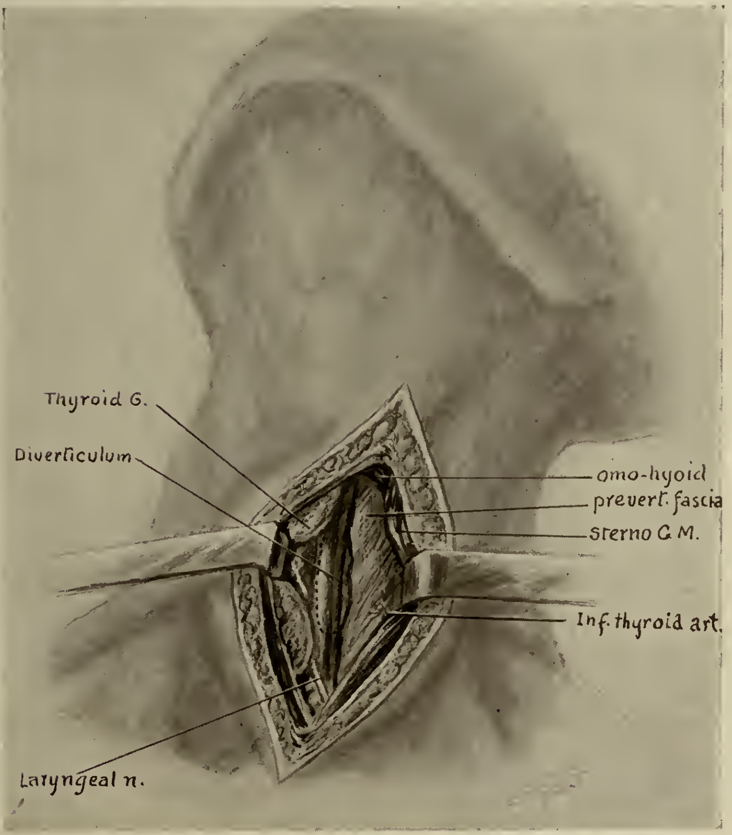


Fig. 48.—Illustrates the exposure of the diverticulum. The sterno-thyroid and sternothyroid muscles, together with the thyroid gland and thyroid fascia, are retracted toward the midline. The inferior thyroid artery has been divided. The diverticulum just shows posterior to the esophagus.

it into the sac, illuminating it very prettily. It will be noticed that the sac is high, posterior to the esophagus, about 2 inches long and very thin. The scope is now angled to present into the wound after the manner of Jackson and Gaub. The sac is now grasped with an Allis forceps and carefully freed from the surrounding structures. This is very easily accomplished in this case (Fig. 49, *A*, *B*).

We have now to decide which method to employ, whether the one-stage or two-stage operation. The inability to pull the sac neck up to the skin edge without too much torsion of the esophagus decides us to employ the one-stage operation.

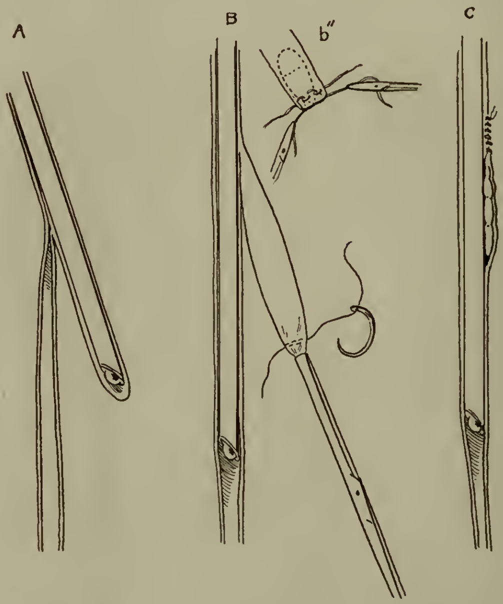


Fig. 49.—*A*, The esophagoscope angles the sac into the wound; *B*, method of suture of the sac; *C*, result after suture.

The width of the neck precludes using a purse-string, and its thin walls incline us to use the multiple suture line invaginating the sac into the esophagus rather than excising it.

Dr. Tucker now passes the scope down the esophagus. This is accomplished with some difficulty due to the width of the sac neck and the obstructing posterior wall of the larynx. It is, however, finally accomplished after twisting the diverticulum on itself, thus closing its wide neck. During our manipulations the top of the sac is torn. We now place a line of No. 00 chromic catgut stitches of the continuous mattress type, paralleling the esophageal long axis and turning in the apex of the sac. The suture is left long at each end to act as stay sutures until the next lower row is ready to invaginate (Fig. 49, *B*). They are then cut and turned in by the next suture. Five rows suffice to reduce the diverticulum flush with the esophagus. In the last two rows we endeavor to keep the needle outside the mucous membrane lining the esophagus. The scope, still in position, prevents encroaching too much upon the normal esophageal lumen. A duodenal tube, without the bucket, is now passed into the stomach and the scope withdrawn. The sutures were placed longitudinally, first because the strain on them is longitudinal through the stretch of the esophageal weight, and, second, it is mechanically easier to so place them. Inspection of our work shows that the longitudinal suture line is posterior, lying directly against the vertebræ (Fig. 49, *C*). A further advantage of the straight suture line is that the tissue turned into the esophagus is in a thin flat shape rather than the bunch of tissue that the purse-string suture would form.

A cigarette drain is now inserted behind the esophagus, well below the suture line, and another shorter drain is placed in the lower angle of the wound. Both are brought out the lower end of the wound, the upper portion of the incision being sutured.

Murphy preferred a two-stage operation. During the first stage the sac is freed, twisted, and sutured. The wound is packed with gauze for twelve to fourteen days, and the sac is then removed. C. H. Mayo employed the two-stage operation, dissecting the sac without opening it, bringing it out of the wound and suturing the skin to the neck of the sac. Ten to twelve days later it is removed without an anesthetic and the edges turned into the esophagus.

The two-stage operation with excision of the sac has given the lowest mortality. The one-stage operation in the hands of several surgeons gave a mortality of 16.6 per cent. in 60 cases reported by Stetten. Provided, however, the sac does not have to be excised or opened, but can be turned in by sutures without danger of occlusion of the esophagus, the one-stage operation is a good procedure. Bevan was the first to suggest a series of purse-string sutures, infolding the sac, where it either atrophies or is sloughed off.

Postoperative Course.—The patient was out of the anesthetic in two hours and could speak in a normal voice, showing that the nerve had escaped injury. He was nourished by proctoclysis, augmented after twenty-four hours by liquids through the duodenal tube. On the third day the duodenal tube became blocked and had to be removed. Another tube could not be inserted, and, as the patient could not swallow, recourse was had to proctoclysis. On the eighth day the last packing was removed and the patient straightway swallowed better. Some temperature led to the suspicion of leakage, although there was no external evidence until the ninth day following operation. This leak continued ten days, and finally stopped twenty-one days after the operation.

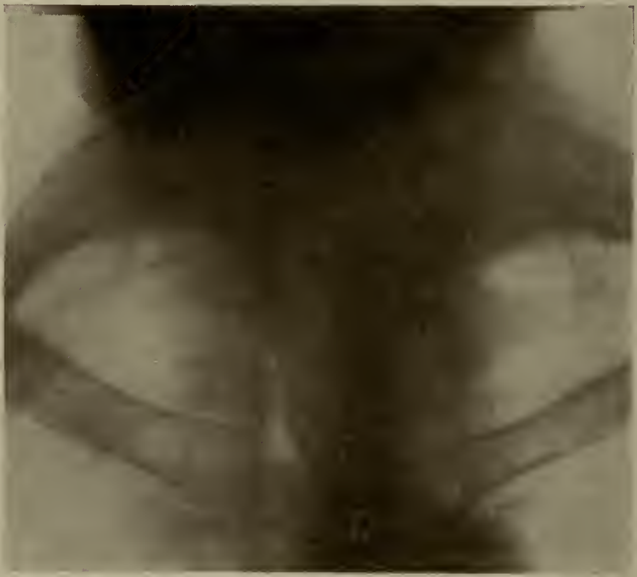


Fig. 50.—*x*-Ray taken following a barium meal five weeks after the operation. The report states there is no evidence of a diverticulum present in either anteroposterior or lateral view.

It is interesting to note that the patient's voice left him on the fourth day and only began to return three weeks later.

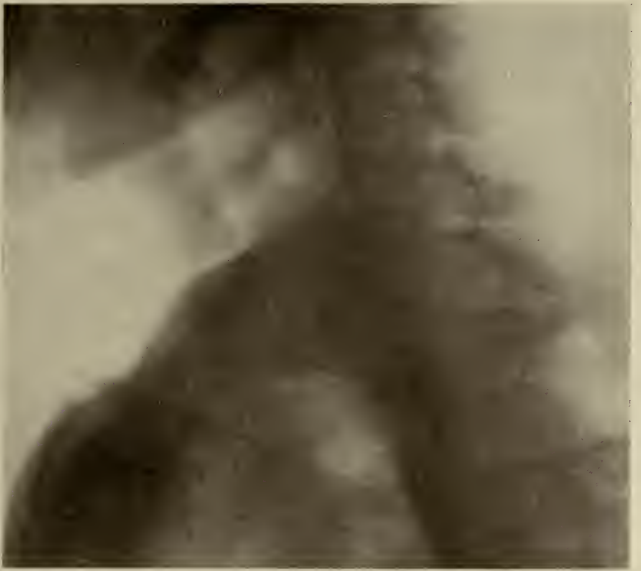


Fig. 51.—*x*-Ray taken following a barium meal five weeks after the operation. The report states there is no evidence of a diverticulum present in either anteroposterior or lateral view.

x-Ray examination five weeks after the operation shows a smooth esophagus (Figs. 50, 51). The patient was able to eat solid food with ease and the neck wound was healed.

SUPRACONDYLAR FRACTURE OF THE HUMERUS

The first case for operation is a boy eleven years old, who ten days ago fell and sustained a supracondylar fracture of his left humerus. An attempt at reduction was made in the Accident Ward under an anesthetic. An *x*-ray taken the same afternoon showed a marked displacement, the lower fragment posterior to the upper fragment (Fig. 60, Case VI, A). Due to the severity of the traumatic reaction, swelling, and bleb formation the limb was elevated and treated with evaporating lotions. Five days later we again attempted reduction under the fluoroscope and found that we could not engage the fragments nor obtain crepitus despite the fact that we could see clearly what we were trying to do. We judged that soft tissue in some way was interfering. Reduction by the open method was, therefore, decided upon.

Operation.—Under gas-oxygen anesthesia the extremity is given its second preparation on the table. We use 5 per cent. picric acid alcoholic solution to paint from the shoulder to the wrist; a sterile towel is now bandaged around the hand and forearm. With the elbow partly flexed we make a crescentic incision about 5 inches long extending from above on the external supracondylar ridge and curving down on to the external surface of the forearm. Wet towels are now sewed, with a continuous silk suture, over the skin edges, being careful that no skin surface is left exposed. With a fresh knife the fascia and aponeurosis is incised through the laceration which you see, and the hematoma at the site of the fracture is opened.

You will note that throughout the operation we are careful to use the sponges in Kelly hemostats or forceps, thus minimizing the danger of hand infection. Furthermore, I will not introduce my finger into the wound unless it is absolutely necessary for the determination of position of its fragments, and only then after changing my gloves. Sponging out the clot and retracting the wound edges we see the lower end of the upper fragment with a nerve looped around the broken surface. This nerve we take to be the musculospiral, from its position and direction. On searching for the lower fragment we find it displaced well to the ulnar side, and lying posterior to the upper fragment (Fig. 52). The nerve is unlooped from around the bone and examined for injury. No gross lesion can be seen. We now endeavor by traction and manipulation to reduce the fracture. We find this is impossible, and close examination discloses the fact that soft tissue in the shape of periosteum and fibrous tissue is interposed and overlaps from in front of the fracture surface of the lower fragment. By the use of a Lane angle iron for the lever we exert slow pressure. Here I might state that traction on a broken bone in which the shortening has existed for some days should always be overcome slowly. Rapid stretching shocks the patient severely. You now see that after two or three minutes the fragments are beginning to assume more nearly their proper relation. My assistant calls attention to the fact that the towel suture at the wound edge has slipped and the skin is exposed, also that there is a small torn place in the little finger of my glove—two slips in technic, which we proceed to correct. By traction on the flexed forearm the fractured surfaces slide into position, the tip of the angle-

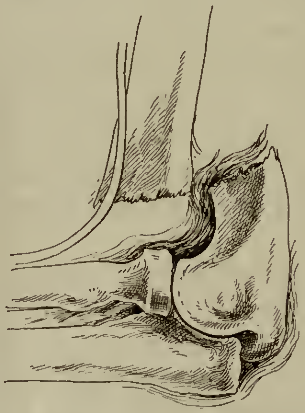


Fig. 52.—Showing the deformity and the musculospiral nerve hooked on the upper fragment.

iron carrying before it the interposed cuff of periosteum and fibrous tissue that is preventing the reduction (Fig. 53). The fragments now stay in position, and with the limb in the Jones position there is no tendency for them to become displaced (Figs. 54 and 60, Case VI, C).

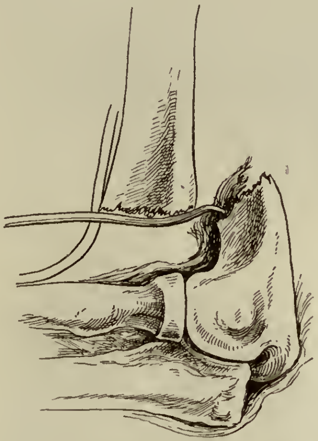


Fig. 53.—Fragments being pried into place after the nerve has been released.

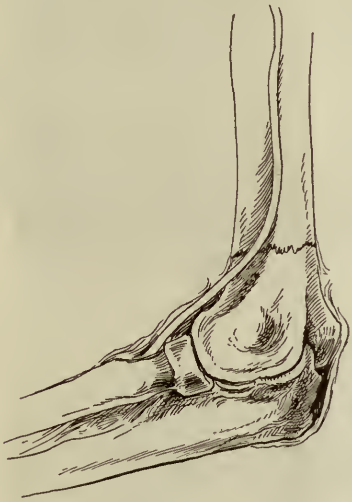


Fig. 54.—Reduction.

You can see that the periosteum has been torn from the shaft of the humerus, being carried back by the attached muscles as we retracted them. In order to minimize the danger of excessive

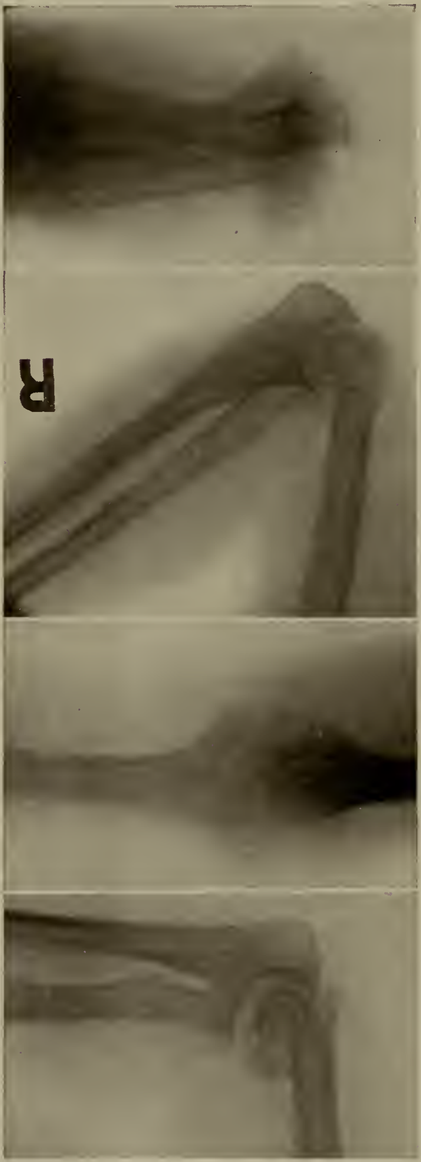


Fig. 55.—Case I.

After second reduction.

After final fluoroscopic reduction.

callus formation the periosteum should lay close to its bone, hence we drain the wound, which is still oozing, to prevent a subperiosteal hematoma.

Postoperative Course.—The day following operation it was noticed that the patient had a musculospiral palsy on the operated side. It must be confessed that the state of this nerve was not noted on his chart before operation, a very grave oversight and fraught with the possibility of serious legal consequences, except for the fact that the patient states that he has not been able to raise his wrist or open his fingers since he broke his arm. We are, therefore, extricated from an otherwise uncomfortable situation.

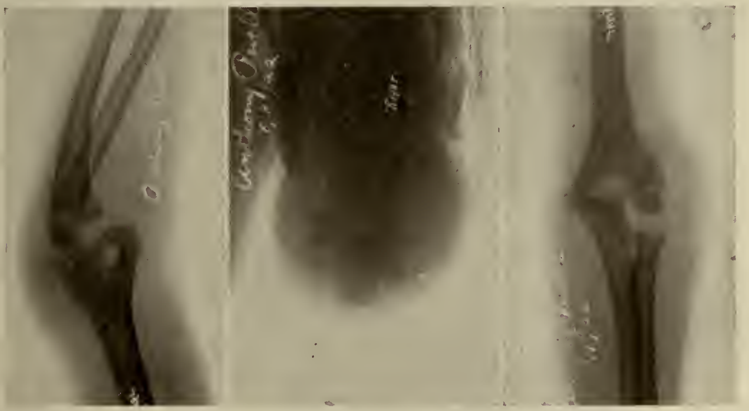


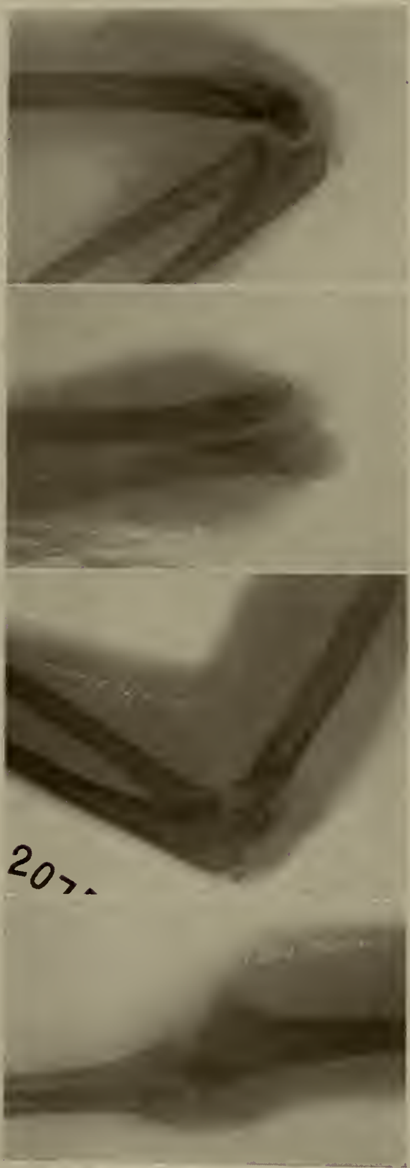
Fig. 56.—Case II.

After first reduction. After fluoroscopic final reduction.

There developed a slight infection in the wound which might be accounted for by one of the slips in technic mentioned above. This rapidly cleared up with one Dakin tube. The wrist was dressed with a cock-up splint.

Follow-up Report.—Two months after the operation examination finds the wound healed, and partial return of nerve function as shown by ability to partially extend the wrist and fingers. The elbow has about 45 degrees of motion in back flexion and extension beyond the right-angle position.

Comment.—When one of these fractures is admitted to our service at the University of Pennsylvania Hospital it is immediately taken to the *x*-ray department and reduced under the fluoroscope, with the patient under an anesthetic. Should the

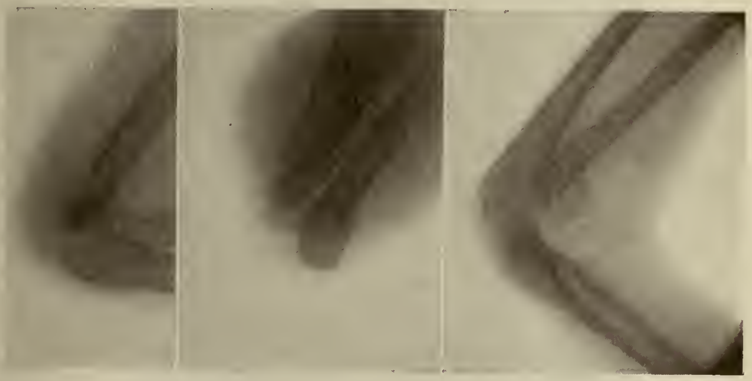


After first reduction.

After fluoroscopic reduction.

Fig. 57.—Case III.

fluoroscope not be available for some hours, the reduction is attempted without it and the limb put on an internal right-angle splint. This splint is used for two reasons—it permits *x*-ray views to be taken in both lateral and anteroposterior directions which the Jones position will not allow readily, and it reduces the danger of the swelling around the elbow interfering with the circulation to the forearm and hand. Should the case come to us in poor position, after one attempt at reduction, a second reduction is always attempted by us with the aid of the fluoroscope. In order to prevent being burnt by the rays the various men on the staff alternate when the cases come closer together than two weeks.



A B C

Fig. 58.—Case IV. After fluoroscopic reduction.

In the last six months 10 of these cases have come under my care in two hospitals, 5 of which (see Figs. 55–59) had had one or more previous attempts at reduction before coming to the hospital. In only one was there the least difficulty experienced in the reduction under the fluoroscope, the results of which are seen in the illustration. The one case of difficulty was the one reported operated upon in this article (Fig. 60, Case VI).

No recent case is operated until a fluoroscopic reduction has failed to such an extent as to jeopardize good functional result.

I wish to call your attention to one more fact before we dismiss this subject: osteogenesis following bone injury in this region is exceedingly active and apparently is stimulated *pari*

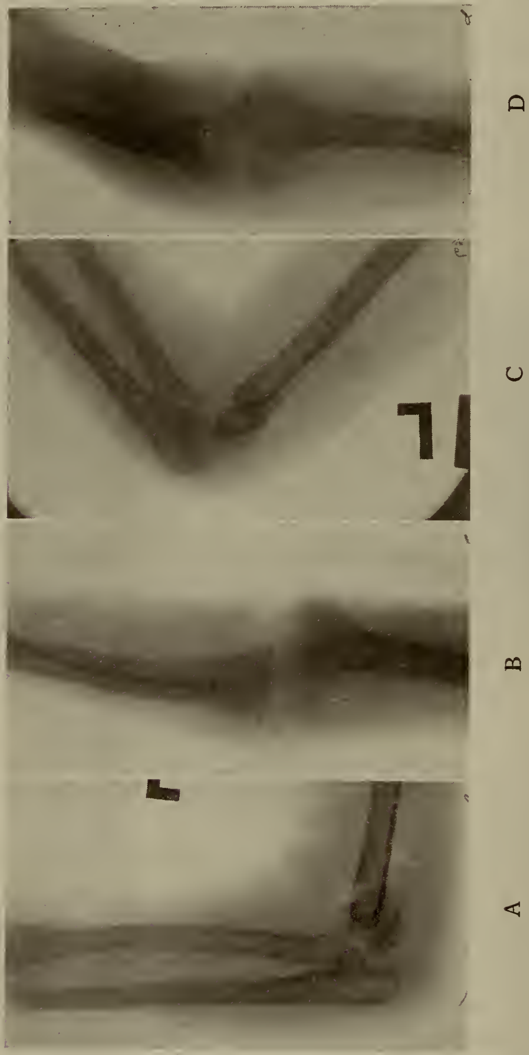
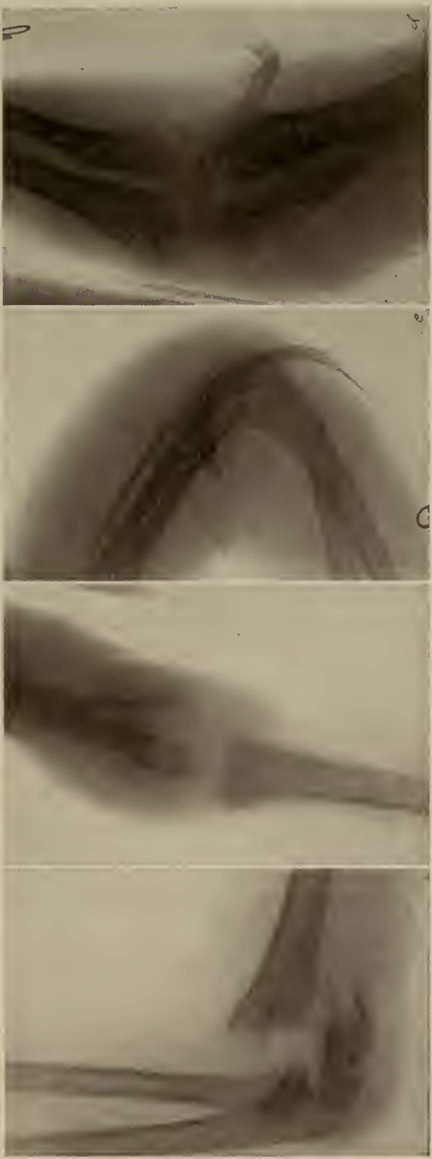


Fig. 59.—Case V.

After first reduction. After fluoroscopic reduction.

passu with the degree of the subperiosteal injury. At least we can say that those cases of marked displacement and large hematomas have resulted in marked periosteal overgrowth.

This is shown very definitely in illustrations of Cases V, A and D and VI, C and D. One case in particular (Case IV) suffered



After fluoroscopic attempt at reduction.

Fig. 60.—Case VI.

After open reduction.

as a result of this activity. Here the hematoma apparently became ossified and united the ulna and humerus by a bony bridge which was complete, causing bony fixation of the joint. This bridge of bone was broken by the passive motion given by the physician.

CONTRIBUTION BY DR. J. LESLIE DAVIS

St. Agnes' and St. Mary's Hospitals

FREQUENT EFFECTS OF MORBID TONSILS NOT COMMONLY RECOGNIZED

That there is a multiplicity of disease processes in the human body which may owe their existence to the influence of morbid faucial tonsils has been widely commented upon, sanctioned by some, and scouted by others, but I think there can be no doubt in the mind of all unprejudiced observers that the full significance of the problem is still but slightly appreciated.

The stumbling-block to many is found in the fact that only acute tonsillar infections present distinctive symptoms or characteristics, while the morbid tonsil of indefinite chronicity may be inconspicuous in physical appearance, diverse in its modifying influence, and wholly void of local subjective symptoms.

Fortunately, the great principle of focal infection seems now to be generally recognized, and its application in the cure and prevention of disease will be rendered more and more practical in proportion to our appreciation of the chief sources of latent sepsis.

My purpose, therefore, in this discussion is to bring to your attention a few pathologic processes which from clinical observation I have found occurring with such remarkable constancy in connection with morbid tonsils, and have appeared also to show a like uniformity in response to the removal of the septic source as would seem to justify a reasonable assumption of an important etiologic relationship.

The several conditions that I shall now present will be considered merely from a clinical standpoint, and that briefly, without attempting to account either for the mode of attack or for the histologic changes that may ensue, calling attention only to such familiar appearances and associated symptoms as might render the phenomena discussed easily recognized.

The first class of cases I shall designate as *Disturbances of regional circulation, interfering, perhaps, with nutrition and elimination and causing disordered function of certain highly sensitized and specialized tissues.* The most common example of this condition may be observed in the very familiar appearance of the membrana tympani in the chronic dry form of catarrhal otitis media. The transformation from the normal translucent, lustrous membrane is usually a very slow process, the earliest detected macroscopic appearance being a faint cloudiness or fogginess, which, unless intercepted, may grow gradually more and more dense and lusterless till its eventual appearance is not unlike ground glass, or in some cases it partakes more of a creamy or ivory-like appearance. This condition, frequently designated as "thickening" of the drum membrane, I am convinced is due to the protracted influence of morbid tonsils in a large majority of cases. It is a phenomenon to which I have paid particular attention for many years, and never have I found the aural condition without the presence, unless previously removed, of diseased faucial tonsils. I have watched the slowly progressive character of the clouding over a period of many years where the cause was not removed, and I have not seen, with but few exceptions, any perceptible further advancement of the process after enucleation of the tonsils, many cases having been examined as long as ten to fifteen years afterward. I know of no measure, however, that will restore the normal translucency and luster of the membrane or remove the clouding or thickening in the slightest degree when once the change has occurred. Such alteration in the drum membrane, of course, is not the full extent of damage effected by this focal infection process, but is usually associated with structural changes in other parts of the aural mechanism—the combined effect of which usually brings about defective hearing varying in degree according to the extensiveness and intensity of the disease. There is little doubt that a large percentage of so-called deafness of old age would have been obviated by the timely removal of a tonsillar focus of infection.

Cataracts.—Tonsillar infection plus intranasal pressure I believe may be found to be a frequent factor in the etiology of progressive cataracts. This opinion, while in a large measure hypothetic, is based upon observations in several cases of senile cataract during the past six years, the characteristic behavior of obstruction plus focal infection in some other tissues, and the opinions of some ophthalmologic authors of wide experience regarding the frequent association of cataract with focal sepsis with its variously allied complications. Henry Kirkpatrick,[1] in his recent text-book, states: "Gastro-intestinal disturbances and oral sepsis are wide-spread in the tropics, and most observers must have been struck by the frequent association of these conditions with incipient cataract in India."

The frequency with which refraction errors of the eye are found to be aggravated by intranasal pressure and obstruction in the ethmoidal area is of interest compared with the following quotation from Kirkpatrick: "An eye, the subject of an error of refraction, appears to be specially liable to the ocular complications of diabetes, nephritis, and focal sepsis, and, if this be so, it is only to be expected that such an eye would be exceptionally susceptible to cataract formation should a constitutional cause of the disease be present." And again we find in the same book this statement near the end of the chapter on Etiology of Cataract: "The cause when present, in a sufficient degree, may produce an opacity by bringing about a degeneration either of the lens fibers or of the capsular epithelium. It may directly affect the cells, or it may produce a disturbance of the function of the structures responsible for the nutrition of the lens fibers and capsular cells. Products of metabolism are allowed to accumulate, which are either directly harmful to the fibers and cells, or which may become so in the presence of more local factors, such as light rays of short wave length."

I admit almost utter unfamiliarity with most ocular diseases, except in their relation to conditions coming within the sphere of rhinolaryngologic practice, my interest in 3 patients afflicted with cataract having been coincidental. All were men, with fairly well-advanced senile cataracts when they came to me for treatment of nose and throat conditions. The first one, sixty-four years of age, was first seen six years ago; the second one, aged sixty-five, first seen three years ago; and the third one, aged fifty, examined six months ago. Each of these cases had remarkably similar nasal obstructions and each had diseased tonsils. High septal deflections, with markedly enlarged middle turbinates tightly wedged against the septum, but actually attached with synechial adhesions to the maxillary wall. Each patient was under the care of an oculist and was expecting in the course of a few months to have to undergo operation for the cataracts. For relief of certain reflexes and systemic disturbances seemingly due to the septic tonsils and nasal abnormalities I removed each patient's tonsils, one middle turbinate, and straightened the septum by submucous resection, under general anesthesia. Results: Each patient obtained marked physical improvement, which has been permanent; all still have as good vision as before operation, without anything further having been done to their eyes, though the last one was too recent to be of significance. The results in these 3 cases, of course, do not prove anything, but are not without significance, and suggest the advisability of looking into other cases, especially those of less advanced stages of cataract, to determine in what proportion may be found similarly combined conditions of tonsillar infection and nasal obstruction, particularly that type of obstruction with marked pressure which might disturb the blood or nerve distribution in the neighborhood of the orbit.

A second class of cases are those where the influence of tonsillar sepsis manifests itself by reducing the vitality of certain more or less circumscribed areas of mucous membrane, favoring superficial ulceration, and followed, in some instances, by the invasion and further destructive influences of specific infections.

The larynx represents one of the fields most susceptible to the effects of septic tonsils. This site of inflammatory complications in the course of acute infections of the tonsils is more generally recognized than is the fact that chronic laryngitis owes its perpetuation in a majority of cases to septic processes within the common type of chronically morbid tonsil. The membranous tissues of the epiglottis, interarytenoid space, ventricular folds, and even the vocal cords are the most frequent sites of infiltration. While laryngeal tuberculosis occurs in a majority of cases secondary to a pulmonary infection, primary infections are occasionally encountered, and I believe it not improbable that the tonsils are a potent factor in each class. It is, furthermore, reasonably certain that with a fuller appreciation of the resistance-reducing influence of tonsillar sepsis on general vitality, as well as that of some of the more susceptible, circumscribed tissues, skilled tonsil surgery could be made one of the most powerful factors in the fight against the great white plague.

The following is illustrative of the laryngeal primary lesion: Male, aged thirty-six years, referred to me on January 22, 1919, with the history of having first developed a persistent hoarseness about a year previously; ulceration of the epiglottis, which soon followed, had gradually grown worse, and laboratory examination had verified a diagnosis of tuberculous ulceration. His previous treatment had consisted of local palliative applications, which were but slightly effective, and constitutional measures, but the patient was constantly losing weight and the pain was beginning to grow rapidly worse. No pulmonary lesion was detected. The feature of importance observed in my examination, besides an extensive active ulceration of the epiglottis and marked infiltration of the interarytenoid membrane was the existence of submerged, spongy tonsils of moderate size, expelling a semisolid grayish substance on pressure.

Briefly, tonsillectomy, under general anesthesia, was decided upon, and carried out two days later without complications; convalescence was normal from the tonsillectomy, and in three weeks' time the epiglottis had completely healed. The patient was last seen April 26, 1920, in perfect health and normal weight, and the larynx looked normal except for the irregular edge of the epiglottis.

Another type of laryngeal infiltration that is apparently a manifestation of morbid tonsils, of which several cases have come under my care, I believe to be typical of the condition which Chevalier Jackson[2] has so aptly described as representing a "precancerous" stage of laryngeal cancer. I quote from his most illuminating and practical article as follows:

"The tonsil has long been recognized as the fountain-head of a majority of the cases of disease of the throat. It has not heretofore been accused of causing cancer of the larynx, but we all know that a focal infection in the tonsil can be the chief etiologic factor in chronic laryngitis; and if we admit, as I think we should, that chronic laryngitis can be a precancerous condition, we must admit that a diseased tonsil can be a cause of cancer. Tonsillar disease is certainly often overlooked in persons of cancerous age."

While we must recognize the impossibility of proving in any case what would have been the ultimate character of an unchecked progressive process, which, from its beginning to the time of its interruption, appeared in all respects to correspond to the classical symptoms of incipient cancer of the larynx (chronic hoarseness, fixation of one vocal cord with "eversion of the ventricle" on the same side), it is at least significant that each of my cases, 3 in number, exhibited such circumstantial evidence; that all had well-marked septic tonsils; that the 2 operated on made almost perfect recovery of the normal function of the larynx within a few months after their tonsils were enucleated, and without recurrence. The third case, a woman sixty-four years of age, was seen only a few days ago for the first time, and the recommended tonsillectomy has not yet been performed. The recovery of normal voice, following tonsillectomy in adults who had suffered varying degrees of chronic hoarseness, is, of course, not unusual. Following is a report of one of the cases of what I now regard as "precancerous" laryngitis, previously referred to:

Male, aged fifty-five years, was referred to me on June 9, 1919 by Dr. John E. Grube.

My letter, written to Dr. Grube on the day of my examination, may give briefly a sufficiently clear picture of the gross appearance to be recognizable to those who have seen similar conditions.

"Dear Doctor Grube:

"In my examination today of Mr. S., whom you kindly referred to me, I am hardly willing to make an unconditional diagnosis, but am afraid that the condition is carcinoma of the larynx. I did not give him an opinion, since he was going to Atlantic City for a week's rest, but told him that I would report to you, and for him to stop by and see me again on his return, at which time I would likely be able to tell him more about it. The left vocal cord is fixed; there can be seen a condition of infiltration of the ventricle and surrounding tissues on that side, and the method of onset is characteristic. Have you ever had a Wassermann examination made for him? Two other conditions that might rarely produce somewhat similar symptoms are syphilis and tuberculosis, but it does not look like either. Of course, any pressure that might interfere with the left recurrent nerve could produce the fixation of the cord, and I would like to know whether you have found any condition of aneurysm or anything in his past history that might throw any light on the situation. He tells me that he has been losing weight. He has rather badly diseased faucial tonsils and by transillumination both ethmoidal areas are considerably congested, but I hardly believe these conditions could account for the laryngeal condition. I shall appreciate any light that you may be able to throw upon this condition in order that I might if possible be able to make a definite diagnosis when I see him again.

"J. LESLIE DAVIS."

The following report was received on June 18, 1919 from Dr. Willis F. Manges:

"Dear Doctor Davis:

"I beg to report as follows in the case of Mr. S. I am unable to find evidence of lesion in any of the accessory sinuses. I am sending herewith the films, which I think are sufficiently clear to further support my opinion with regard to them. I also made a fluoroscopic study of the chest, but found no evidence of pathology that could in any way affect the recurrent laryngeal. The view of the larynx shows no abnormality which could be seen by means of *x*-ray plates. That is, there is no unusual hardening of the cartilages, nor, as far as I can see, destruction of any of the tissues in this region.

"Yours very truly,
"W. F. MANGES."

Blood examination made June 18, 1919 by Dr. E. D. Funk, was as follows:

"Patient—Mr. S. Specimen—Blood.

"White blood-cells, 8600; polynuclears, 55 per cent.; large mononuclears, 4 per cent.; small lymphocytes, 39 per cent.; eosinophils, 2 per cent.

"The red cells are apparently normal in their morphology and staining reactions.

"The Wassermann serum test was *negative.*

"Respectfully submitted,
"E. D. FUNK."

Mr. S. had been conscious of slight hoarseness for several months, which had become gradually more and more pronounced, until for the past month his voice was extremely "husky." He had not suffered any pain, nor had there been but little cough, and that intermittently; general health had always been fairly good and he had never had rheumatism. Had been steadily losing weight for several months.

Tonsillectomy was performed on June 30th, under nitrous-oxid-ether anesthesia; his convalesecence was uneventful. In ten days' time the patient stated that his throat was distinctly more comfortable than before operation, in that he could speak with greater ease.

The patient was next seen on November 1st, when the following note was made: "Left vocal cord almost normal in point of physical appearance and in movement on phonation; voice nearly normal." I had not seen or heard further from him till today, when, in reply to inquiry sent to Dr. Grube, I received the following statement: "Mr. S. is enjoying perfect health and his larynx seems practically normal; in talking to him over the telephone a few minutes ago I could not tell that there had ever been anything wrong with his voice."

One of the most frequent locations for simple ulcerative processes, and usually uncomplicated by mixed infections, is the somewhat circumscribed area on the anterior surfaces of the nasal septum, it may be unilateral or bilateral, characterized by atrophy of the mucous glands, hemorrhage of varying degree and frequency, according to the depth of ulceration and particular location with respect to blood-vessels, and occasionally eventually leading to perforation of the septum. Such perforations may be hastened by syphilitic complications, and before the discovery of the Wassermann test doubtless was attributed many times unjustly to that cause. These cases vary in their disturbing features, from the patient's standpoint, from a simple annoyance owing to the dryness, crusting or scabbing, provocative of the "nose-picking" habit, with occasional slight "nose-bleed," to frequent, prolonged hemorrhages that ultimately may bring about a state of marked anemia, rendering more difficult the task of stopping each hemorrhage and each hemorrhage further aggravating the anemia.

The following case will illustrate a severe type of septal ulceration:

Male, aged forty-nine years, was referred to me in September, 1919 by Dr. C. B. Warden, with the history of having been subject to nosebleed for the past fifteen years, the condition having gradually become more and more aggravated until, according to the patient's statement, he had not missed a day without hemorrhage for the past year. During recent years he had been regarded as a hemophiliac, though there was no family record to that effect. On removing the packing which had controlled a severe hemorrhage the previous day, I found the anterior septal surface of each side, in area almost the whole cartilaginous portion, had a granular appearance, thin, but without any entirely denuded area of cartilage. The very free hemorrhage which ensued was checked by repacking. In my further examination the faucial tonsils, larger than the average adult size of morbid tonsil, were of the very soft "mushy" type, almost concealed by overreaching anterior pillars, and containing, in considerable quantity, a grayish liquid of creamy consistence. The patient's hemoglobin was 45 per cent. and the clotting time six and a half minutes. The tonsils were enucleated a few days later, under general anesthesia, without difficulty of controlling hemorrhage—except for the matter of ligating several more than the usual number of vessels that we are accustomed routinely to tie following every tonsillectomy. Effect on septal ulceration: Local repair processes could be detected within a few days; healing of the tonsillar fossæ was complete in two weeks, by which time nasal packing was discontinued and within six weeks the previously ulcerated septal surfaces were covered by healthy cicatricial tissue and the patient showed marked physical improvement.

Thus, when we contemplate the variability in the manner of toxic distribution and the diversity of disease processes resulting directly, indirectly, or ultimately from focal infection within the cryptic recesses of morbid tonsils, it would be difficult to comprehend the mental processes of those who are still occasionally heard to express alarm over what they term "ruthless sacrifice of innocent tonsils," were it not so evident that they have, in most instances, innocently formed their prejudices concerning the removal of tonsils from the pitiable results of censurable surgery. It is not the tonsils that are in need of a savior so much as it is the operator devoid of instruction, but with no dearth of temerity.

Dental sepsis has been thought by some a close rival of the morbid tonsil for supremacy in the capacity of toxic distribution, but, if all faulty tonsils were eliminated in early childhood, pyorrhea, apical abscesses, and associated carious conditions would soon become a negligible force, for I am persuaded that the faucial tonsils are important in the earliest influences toward dental decay.

If, then, there still continue to be some who find comfort in their cloak of so-called "conservatism" simply because the tonsil *seems* so unoffending in its *physical appearance*, it is to be hoped that they will for a while make their observations in the reverse order, for "by their fruits ye shall know them!"

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CLINIC OF DR. P. G. SKILLERN, Jr.

University of Pennsylvania Medical School

CASE I. SUBMAXILLARY SALIVARY CALCULUS IMPACTED AT GLAND ORIFICE OF DUCT; SIALO ADENITIS, CHRONIC: ABLATION OF SALIVARY GLAND

Summary: History of case; operation; comments—characteristic symptoms; importance of x-ray examination and proper technic for same; differentiation from alveolodental infection—illustrative case.

T. M., FEMALE, aged twenty-five, stated that on May 14, 1917 she noticed for the first time a swelling beneath the angle of the right side of the mandible; this swelling has undergone rapid increase and diminution in size—particularly at meal-time—but has never entirely disappeared, but, on the whole, has slowly grown larger. She has not noticed any definite cutting pain beneath the tip of the tongue. The swelling causes inconvenience by giving rise to pain at times and interfering with speech and deglutition.

Physical examination on May 14, 1918 reveals a tumor the size of an English walnut, corresponding to the position of the right submaxillary salivary gland. This tumor is hard, but not adherent to surrounding structures; the overlying skin is neither red nor inflamed. When the patient opens her mouth and curls the tip of her tongue back a drop of turbid fluid with white flakes appears at the orifices of the duct of Wharton on the right side; this drop is made larger by pressure upon the enlarged submaxillary salivary gland.

Operation (May 15, 1918).—Ether. Curved incision made as for ligation of second portion of lingual artery, beginning just below right angle of jaw, passing down to hyoid bone, and terminating 1 inch to right of symphysis of jaw, dividing skin, superficial fat, and platysma, and exposing deep fascia. Superficial veins clamped and ligated. Deep fascia capsule of salivary gland divided and retracted, exposing gland itself. By blunt dissection the gland was freed on all sides; externally the facial artery was encountered and drawn aside. The duct of Wharton was exposed by raising the posterior border of the mylohyoid muscle and was divided ½ inch from the gland. The platysma and deep fascia were closed with interrupted sutures of No. 1 chromic gut. The skin edges were apposed by a continuous suture of horsehair. A rubber-dam drain was placed in outer angle of wound. Dry gauze dressing.

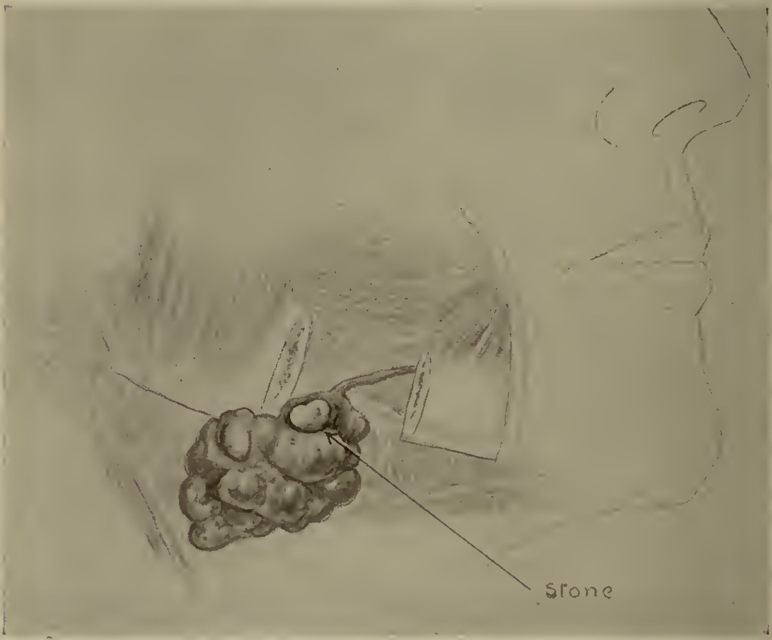

Fig. 61.—Salivary calculus impacted at gland orifice of Wharton's duct.

Postoperative Notes (May 16th, day after operation). Drain removed.

May 22d (one week after operation): Sutures removed; a small amount of thin fluid came out through the suture holes.

Pathology.—A calculus the size of a pea was found blocking the gland orifice of the duct of Wharton (Fig. 61). The gland itself was knobbed and indurated.

Comments.—Jones[1] reports a case of large calculus embedded in the submaxillary gland in an acromegalic. His analysis of numerous articles reveals a characteristic set of symptoms. The primary symptoms are sudden onset of pain in the floor of the mouth over the submaxillary region, or that of the other salivary glands, associated with swelling and exquisite tenderness, all increased by food and mastication.

Physical examination is aided by bidigital palpation and *x*-ray examination. Ivy states that a large dental film placed horizontally between the teeth, as far back as possible, with the rays directed from beneath the chin, will usually reveal the calculus. In severe cases the floor of the mouth is very swollen and tender, so that speech and deglutition are painful, as in our case. Abscess of the affected gland may be present, with necrosis and even fistula formation; and cases have frequently been diagnosed as carious teeth with root abscesses to be contradicted by *x*-ray.

Illustrative of these possibilities is a case under treatment at the present time, a doctor's son, who presented himself with a large indurated abscess beneath the mandible and pointing in the submental space, very much like Ludwig's angina. The abscess was incised where it pointed, giving exit to pus with an odor resembling the colon bacillus infections. Skiagrams of the teeth revealed no dento-alveolar infection. As time went on the discharge of pus cleared up, but a mucoid material resembling saliva was discharged in small amounts from the incision, and when the latter scabbed over, this fluid dammed itself back along the floor of the mouth, causing edema and tenderness of the plica sublingualis, these signs subsiding upon removal of the scab and evacuation of the mucoid fluid. No calculus was detected by *x*-ray. A month or so later the patient returned, with a small swelling at the site of the previous incision. On lancing the swelling, seropus escaped, which, when looked at in the pus basin, revealed a few of the sulphur granules typical of actinomycosis infection. Microscopic examination showed the ray fungus.

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[1] Annals of Surgery, May, 1921, 73, 527.

CASE II. FRACTURE OF SEMILUNAR CARTILAGE OF KNEE WITH FRINGE PINCHING; ABLATION OF CARTILAGE; RECOVERY

H. P., MALE, aged forty-two, machinist, was referred by Dr. W. Horace Means, surgeon to the Bethlehem Steel Company, with the history of having twisted his right knee while at work several months previous to the time of the examination on August 12, 1922. He now complains chiefly of sharp pain in the knee on extension, and also of pain that keeps him awake until about 2 o'clock in the morning. Physical examination only revealed a localized spot of tenderness where the inner border of the ligamentum patellæ crosses the anterior edge of the articular surface of the tibia. Damage to the internal semilunar cartilage was suspected, and exploration of the knee-joint was advised.

Operation (August 13, 1922).—Ether. Horizontally curved incision made through skin and fasciæ, lowest point of convexity reaching to midway between patella and tubercle of tibia. Flap dissected up. Quadriceps tendons, patella, and ligamentum patellæ divided in Z-shaped manner, the two resulting flaps being reflected, with excellent exposure of the joint structures. Examination of the internal semilunar cartilage showed that it was split at its anterior extremity and, in addition, there was flattening of two synovial villi, which lay upon the upper surface of the cartilage in a position to be pinched between it and the femur, thus accounting for pain on extension of the knee. The entire internal semilunar cartilage was ablated, together with the hypertrophied synovial membrane at its anterior extremity, including the pinched and flattened villi. Bleeding checked by hot normal saline solution. Z-shaped flaps of quadriceps tendon, patella, and ligamentum patellæ apposed and sutured with interrupted sutures of No. 2 chromic gut. Semilunar superficial flap sutured with interrupted sutures of silkworm gut. Rubber-dam drain inserted at each angle of wound between superficial and deep flaps, but not extending into joint. Copious dry gauze dressing applied. Limb securely bandaged from foot to hip.

Postoperative Notes (August 14th, twenty-four hours after operation).—Has had sharp, throbbing pain in knee since coming out of ether. Dressed. Rubber drains removed; much serosanguineous discharge on dressing from mesial subcutaneous drain. Buck's traction (10 pounds) applied. Ice-cap placed on knee. Temperature, 100° F.; pulse, 88.

August 15th (forty-eight hours after operation): Pain less; only has throbbing at intervals. Slept fairly well. Bowels moved by enema. Temperature, $99\frac{3}{5}$° F.; pulse, 82; respiration, 22. Girth of thighs 3 inches above joint: Right, 21 inches; left, 20 inches. Light diet.

August 16th (third day after operation): Pain and tenderness less. Temperature, 99° F;. pulse, 80; respiration, 20.

August 17th (fourth day after operation): Temperature, $98\frac{3}{5}$° F.; pulse, 82; respiration, 22. Pain and tenderness less. Wound examined and found clean; moderate reactionary swelling; patella not floating; girth—3 inches above joint—1 inch increased.

August 20th (seventh day after operation): Temperature, 98° F.; pulse, 80; respiration, 20. Bowels moved freely by calomel and salts. Stitches removed; healing *per primam* throughout. Buck's traction removed. Motion present and painless.

August 23d (tenth day after operation): No pain on extension of knee as before operation. Girth—3 inches above joint—$\frac{1}{2}$ inch greater than left limb. Up out of bed on chair.

August 25th (twelfth day after operation): Is up and about on crutches. Discharged from hospital and sent back to Lebanon.

September 17th (five weeks after operation): Can flex knee to 35 degrees. Has had no pain on extension of knee similar to that which was present before operation. There is still some edema of knee and leg. Massage and passive motion are being used. Pateint still walks with crutches. Owing to the patient's excessive weight, complete restoration of function is not expected before the end of the sixth month after operation.

Notes from Dr. Means (December 22d—four months after operation): "P—— is working as a watchman, but with seeming difficulty. He complains of a fairly constant pain—made worse by use—below the knee, anteriorly and under the scar; this pain prevents him from ascending steps in the normal fashion and forces him to ascend one step at a time. He also says that he cannot bear his full weight on the leg in the fully extended position, but must partly flex the knee. He speaks of a weakness in the internal aspect, but says the former pain over the internal meniscus has disappeared. The leg appears swollen, especially above the knee, but the patient states the evening swelling is not so great as formerly. The leg feels better when tightly strapped, so I have ordered him an elastic bandage with a pad over the internal aspect of the knee. I believe his excessive weight has a good deal to do with his inability to use leg his properly, and I hope by plugging away with baking, high frequency, and massage we will attain the desired result."

Comments.—Exploration of the knee-joint, or exploratory "laparotomy," as it has been aptly termed, is an operation that should be more frequently employed. The living pathology of this joint has not been worked out so fully as that of the abdomen because there is still a tendency in the traumatic cases that drag along into the subacute and chronic stages, routinely to employ the time-honored plaster-of-Paris fixation and crutches. We recall a patient who had been treated by these measures without relief, and whose knee, upon exploration, revealed extensive hypertrophic villous synovitis; excision of the involved portion of the synovial membrane together with the hypertrophied villi resulted in cure with excellent function. (For full report of this case see International Clinics, vol. iv, 31st series, 1921, p. 61.)

Another case emphasizing the importance of free exposure of the joint by exploratory arthrotomy in obscure cases is the following: A machinist aged eighteen years stated that five months previous to admission while at work he jumped down 3 feet on to a plank, which gave way, and he landed on his left knee, which was thrown into flexion. He got up and found his knee out of control, and a lump appeared on the *outer* side. The joint soon began to swell. He was put to bed for ten days, but no traction was applied. At the time of admission he is able to walk on the knee, but it plays out; it slips and throws him and remains swollen. Something slips at the side, and the patient goes forward; if it goes back with a distinct click the patient is able to bend his knee again; otherwise he cannot. Physical examination showed no apparent swelling; the landmarks and bony prominences were clear and distinct. There was a tenderness (a "sickening" sensation) on pressure over the anterior third of the lateral surface of the external condyle; less over the internal condyle; still less over the ligamentum patellæ. *x*-Ray examination negative. Exploratory operation revealed on the outer face of the external condyle—just below the outer patellar ridge—a fragment of cartilage-covered bone, the size and shape of a small lima bean, broken off and remaining movable within the limits of a few fibrous bands that held it against the femur. The synovial membrane in relation with this fragment as a center was red and velvety from irritation; there was, however, no excess of synovia in the joint. The cartilage-covered bony fragment was removed. Both semilunar cartilages were carefully examined, but found intact.

If one should start out with a preconceived diagnosis of injury to a semilunar cartilage, make the usual limited and confined incision for the removal of the latter, and not find the cartilage definitely injured, one would have to close and then make the free exploratory arthrotomy incision. Again, as pointed out by Smith, a true lesion of the semilunar cartilage may be associated with a tear in the anterior crucial ligament. It is, therefore, conceivable that ablation of the semilunar cartilage alone without further exploration has been responsible for a certain number of failures even when a torn semilunar was definitely repaired (Roux-Berger). Midline splitting of the quadriceps tendon, patella, and ligamentum patellæ may be considered a rather formidable procedure; in fact, it does look formidable at the operating-table, but the wound heals promptly and without any permanent injury to the joint. Better than the midline incision of Robert Jones, however, is the Z-shaped method employed by Murphy, which affords more satisfactory exposure of the deeper recesses of the joint.

Objection has been raised to the transversely curved superficial flap on the ground that gangrene might occur when the flap is dissected to some distance above the patella. Gangrene is not apt to occur, however, if one has the lowest point of convexity of the flap opposite the midpoint between the patella and the tubercle of the tibia, and also if one takes care when raising the flap to dissect the fat cleanly from the underlying deep fascia and aponeurosis, thus safeguarding the superficial blood-vessels.

Immobilization in plaster of Paris is not indicated after exploratory arthrotomy of the knee, provided the anterior crucial ligaments are intact, for it militates against the early resumption of motion by the joint. Buck's traction is indicated for about ten days to keep the synovial surfaces apart, to counteract muscle contraction, and to effect a compromise between absolute immobilization and unchecked mobility.

If hemarthrosis appears after operation early aspiration should be done.

CASE III. METASTATIC CARCINOMA OF CERVICAL LYMPH-NODES WITH HYPERALGESIA; ABLATION, WITH RESECTION OF INTERNAL JUGULAR VEIN

J. S., MALE, aged forty-one, cabinet-maker, referred by Dr. J. Lynn Mahaffey, of Camden, New Jersey, on April 29, 1922, stated that for twelve years lumps have been appearing first low down in the left side of the neck, becoming hard and sensitive, and later extending upward along the left sternomastoid muscle, gradually increasing in size. He has had an attack of tonsillitis, but his throat feels raw and smarts, and there is a sensation as though there were constantly something to raise. He has no nose or ear trouble. There is no expectoration, nor is there any loss of weight.

Physical examination of the left side of the neck reveals along the carotid sheath a chain of hard nodes enlarged to the size of beans, while low down above the clavicle there is a hard, fixed node the size of a large grape. These enlarged nodes are characterized by great sensitiveness, both to the lightest touch of the fingers and to the pressure of the clothing. No areas of softening are palpable in the nodes and there are no fistulæ. A skiagram of the chest was made and tuberculosis was reported, although there are no active pulmonary signs of such a lesion at the present time. The blood Wassermann reaction was negative. There is a healed scar on the left side of the neck 2 inches long from a previous operation.

This patient had been operated upon elsewhere about a year previously, and while some of the enlarged nodes were removed, a small cluster over the middle of the carotid sheath was left remaining, being considered inoperable. It was the hypersensitiveness of this cluster that led the patient to seek further operative measures.

Operation (May 16, 1922). Ether.—Sand-bag beneath shoulders; head turned to right. L-shaped incision along anterior border of sternomastoid muscle and then outward, parallel with clavicle and just above it. Flap of skin and fascia dissected upward and turned back on its posterior hinge. Sternomastoid muscle retracted, exposing carotid sheath. Posterior belly of omohyoid divided to obtain a better exposure. Carotid sheath opened. A mass of nodes the size of a large grape was found adherent to the contents of the sheath and compressing them; when dissected from the common carotid artery the latter expanded to twice its original diameter. While dissecting the vagus nerve from the mass it was noted that the pulse-beats slowed down 50 per cent., at once resuming their former rate when the nerve was free and no longer subjected to trauma. Coming now to the internal jugular vein, it was found impossible to dissect the mass from this structure; therefore the vein was ligated above and below the mass, resected, and removed with the latter. The large subclavicular mass was removed and, on section, found firm and gristly. After removing whatever smaller nodes remained, the posterior belly of the omohyoid was sutured and the wound was closed, rubber-dam drainage being inserted beneath the superficial flap.

Postoperative Notes (May 23d—seventh day after operation).—Stitches removed; healing *per primam* throughout. After operation the voice had been reduced to a whisper, but it is now returning. The patient can turn his head in all directions without any pain.

August 2d—(two and one-half months after operation): Patient states he has gained 18 pounds since the operation and that his voice is gradually regaining its former depth of tone.

Comments.—The most striking feature of this case was the exquisite tenderness of the enlarged lymph-nodes; the lightest touch of the finger caused the patient to wince; the weight of the clothes caused almost intolerable pain, and at night resting upon the left side prevented sleep. In the absence of inflammation this tenderness is explained by the tenseness of the capsules and deep cervical fascia, while the pain that radiated to the shoulder, and that was relieved by removal of the tumors, was due to pressure upon the third and fourth cervical nerves.

Surgical dissections in the neck are much simplified by free incision and free exposure. It is after the deep cervical fascia is freely divided and retracted that the deep structures of the neck so beautifully reveal themselves. To obtain free exposure and avoid blind dissection it may be necessary in some cases to divide the diagastric, omohyoid, or even the sternomastoid muscle, but provided these muscles are sectioned distal to their motor nerves and carefully sutured, no harm is done, and much annoyance and time are saved. In the goiter operation the infrahyoid muscles are divided with impunity, and so are the recti in transverse abdominal incisions. That chief disturber of the surgeon's composure—the internal jugular vein—may be ligated and resected with the tumors without special danger, and with relief from much anxiety. It was interesting to note the ballooning out of the common carotid artery after relieving the pressure, and the effect of stimulation of the vagus. An excellent article on tuberculous cervical adenitis by that master surgeon, John H. Jopson, appeared in this publication last year (Surgical Clinics of North America, Philadelphia Number, February, 1922, pp. 187–197).

CASE IV. UNUNITED FRACTURE OF RADIUS (LEFT): AUTOGENOUS BONE-GRAFT INLAY; DEFECTIVE OSTEOGENESIS; FRACTURE OF GRAFT

W. L., male, aged fifty-one, steamshovel engineer, was referred by Dr. W. Horace Means, surgeon to the Bethlehem Steel Company, Lebanon, Pennsylvania, on July 6, 1922. This patient received his injury on November 21, 1921; while using an air-compressor the hose suddenly became wrapped around his left forearm, so extremely supinating the hand as to fracture the lower third of the radius and the styloid process of the ulna. The deformity was reduced immediately, but after a few days it recurred, and six days after the accident a Lanè plate was applied. Two months later the patient complained of pain at the site of fracture; a skiagram revealed absorption of bone around the screws, and the plate was therefore removed on January 27, 1922, at which time there was firm union of the fragments. There was now found partial ankylosis of the shoulder-, elbow-, and wrist-joints, which was treated by baking and massage. On or about May 15, 1922 the patient noticed a prominence of the head of the ulna, evidently due to absorption of the callus between the bone ends, permitting the radius fragments to override. In February, 1922 the patient was given oxyliodids, owing to the presence of a 1+ positive Wassermann reaction.

Physical examination of the left upper extremity reveals that the left hand rides up on the radius, making the ulnar styloid process more prominent. Palpation of the radius determines an angular deformity at the junction of the lower third with the upper two-thirds, the apex of the angle facing the ulna; there is also preternatural mobility at this site. Sensation along the dorsum of the thumb is impaired, and since the injury the patient has had pain about the head of the ulna on motion (ununited fracture of styloid process?). Skiagram

(Fig. 62) reveals angular deformity, absorption of callus, and pseudarthrosis. Wassermann reaction positive 1+.

Operation (July 25, 1922). Ether.—Incision of 4½ inches along radial border of radius, but not through previous operation scar. Tissues retracted, exposing radius; the ends of the fragments were found displaced toward the ulna, and slightly overlapping. There were pseudarthrosis between the ends and atrophy of the latter, but above the end of the proximal fragment a mass of callus was found. The pseudarthrosis was excised, the fragments were placed end to end, and with the Albee motor saw (twin blades) a slot about 3 inches long and ¼ inch wide was cut along the radial border of both fragments preparatory to the insertion of an inlay bone-graft. The resulting lengths of bone were removed from the slot and put aside in saline solution to make bone-crumbs out of. From the left

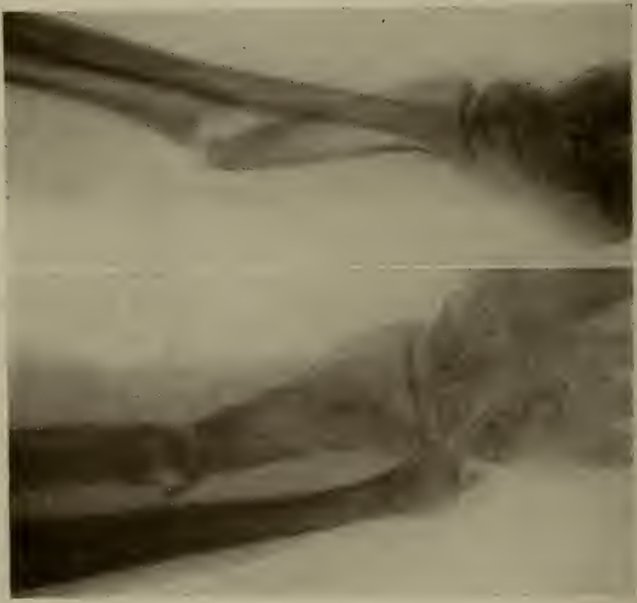

Fig. 62.—Ununited fracture of radius and styloid of ulna before operation. Note angulation, pseudarthrosis, and sclerosis of proximal end of distal fragment.

tibia a bone-graft of suitable size and with periosteum attached was obtained; in order to make a tight fit this graft was cut as much wider than the bone fragments removed from the radial slot as the combined width of the edges of the twin saw blades. One end of the inlay graft was beveled and driven down into the cancellous tissue of the lower end of the radius; the other end was beveled and placed in the medullary canal above the slot while the intermediate portion rested in the slot and was secured by kangaroo tendon tied around the bone and over the inlay. The periosteum with overlying muscles and tendons still attached was sutured over the graft area after inserting bone crumbs (separate foci of osteogenesis) between the periosteum and the graft and between the ends of the radius fragments. The skin edges were approximated with a continuous

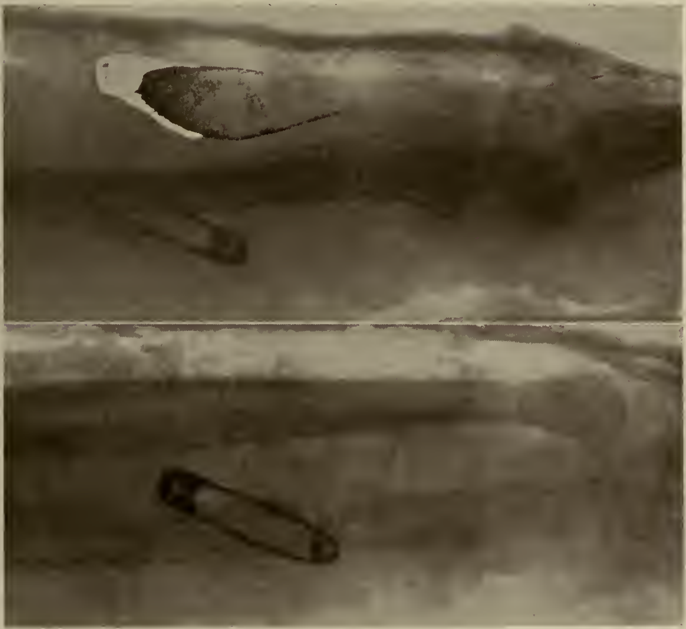

Fig. 63.—Ununited fracture of radius after insertion of bone-graft. Note bone-crumbs placed between fragments to act as separate foci of osteogenesis. Note also that ununited ulnar styloid has been removed.

interlocking suture of No. 1 plain gut. No drainage was employed. A gauze dressing was applied and over it a copious layer of cotton was placed, the whole being encircled by a gypsum case extending from the base of the thumb up to the semiflexed elbow. A padded internal angular splint was then applied so as to fix the elbow-joint. The forearm was suspended from the neck by a triangular sling. It should be stated that before applying the dressing the fractured and ununited styloid process of the ulna was removed through an incision over the head of the ulna.

Postoperative Notes (September 16, 1922—seven weeks and four days after operation).—Gypsum case removed. The radius fragments and graft are apparently firmly united; the skiagram (Fig. 63) shows these structures in good position. Yucca board splints applied.

December 11, 1922 (four and a half months after operation): Examination of left forearm shows distinct crepitus; skiagram reveals fracture of graft and disturbed alinement of fragments. Double metal splints applied, immobilizing the wrist-joint, and calcium lactate and cod-liver oil pushed. Pain at head of ulna, which was due to the fractured and ununited styloid process, has not been present since the latter was removed. Injections of neo-arsphenamin are being continued.

Comments.—In the Philadelphia number of the Surgical Clinics of North America for February, 1922 (Vol. 2, No. 1, pp. 271–277) we presented 2 cases of ununited fracture of radius and ulna, in both of which the same operative procedure was employed, with excellent results. Should the case herewith presented not ultimately result in union it would fall into the category of 19.1 per cent. failures with the inlay method, of which McWilliams,[1] from an analysis of all graftings reported in the literature, together with the results obtained from a questionnaire, states that with the inlay method 80.9 per cent. are successful. Working against us we had atrophy of the ends of the bone, which is well shown in the skiagram (Fig. 62), where not only is the proximal end of the distal fragment conical, but the medullary canal for a distance of ½ inch from the end is obliterated and filled with sclerosed osseous tissue; the latter, however, is an absolute contraindication to the use of metal plates, which might hold the ends in alinement until doomsday without union resulting; while in the case of the bone-graft the medullary canal is opened up when preparing the gutter, and the inlay graft *in situ* ordinarily conducts healthy and vigorous bone-cells from the uninvolved portion of the medulla and endosteum to the site of fracture. Likewise working against us was fracture of the graft, although this occurred remote from the operation at a time when internal fixation is usually no longer so vital, and fractures of these grafts frequently heal, therefore serving to stimulate rather than retard callus formation between the bone ends themselves. That the 1+ Wassermann reaction was an unfavorable factor cannot be gainsaid, for lues in some manner does adversely influence the nutrition of bones, although in this patient the tibial gutter from which the graft was obtained filled up with new bone in the usual average time of from four to six weeks. The patient was given a course of antiluetic treatment before the bone-graft operation was undertaken, and under these conditions it was not thought inadvisable to operate in the face of only a 1+ Wassermann reaction. This entire subject of imperfect regeneration of bone offers a fertile field for investigation. In this case if, after a not too prolonged period of immobilization and constitutional treatment, union does not result, the question of reoperation, with the insertion of a much longer inlay graft, will be taken up.

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[1] Annals of Surgery, September, 1921, 74, 286.

Note (February 15, 1923).—A skiagram taken today after removal of the fixation splint reveals apparent union with excellent alinement of fragments.

CASE V. NEUROMA OF MUSCULOSPIRAL NERVE ABOVE ELBOW: NEUROLYSIS

M. S., MALE, laborer, aged fifty-four, was referred to us by Dr. W. H. Means, surgeon to the Bethlehem Steel Company, Lebanon, Pennsylvania, on October 12, 1922. On July 6, 1922 the patient caught his right arm between a moving belt and a pulley, crushing the arm, contusing the shoulder, and luxating the head of the radius. Inspection soon after the accident revealed a brush burn of the arm and subcutaneous ecchymosis in the middle third of the arm, while palpation detected forward luxation of the head of the radius. It was evident that all tissues of the upper arm from the skin to the bone were more or less crushed, as the patient could not flex the elbow, sensation and motion were lost in the distribution of the median and musculospiral nerves to the forearm and hand, and sensation was impaired in the digital distribution of the ulnar nerve. Since the accident the median and ulnar nerves have recovered themselves.

Physical examination of the right upper extremity reveals limitation of motion of the finger- and wrist-joints, inability to extend the fingers, wrist, to rotate the radius, to flex the forearm, or to move the shoulder-joint without rotation of the scapula (ankylosis of shoulder-joint). There is dystrophy of nails of thumb, index- and middle fingers, and there is also drop-wrist. There are no disturbances of sensation except in the distribution of the radial nerve, where sensation is lost. More complete and detailed neurologic tests were carried out by Dr. Charles S. Potts, who agreed that there was compression of the musculospiral nerve above the elbow, and that exploration of the nerve was justifiable.

Operation (October 18, 1922).—Ether. Usual incision made for exposure of musculospiral nerve in the lower third of its course. Working down in interval between brachioradialis laterally and biceps and brachialis mesially the musculocutaneous nerve was encountered and drawn aside, and the musculospiral nerve was come upon surrounded by and embedded in scar tissue and the seat of a neuroma about 4 inches above the line of the elbow-joint. The nerve was freed from the scar tissue surrounding it, and multiple incisions were made through the cicatricial covering of the neuroma and parallel with the long axis of the nerve. The neuroma and adjacent portions of the nerve were then buried in nearby muscle tissue, and the wound was closed without drainage. Another incision was made more mesially from shoulder to elbow over the biceps muscle, and the belly and three tendons of the latter, as well as the upper portion of the musculocutaneous nerve, were examined to determine the cause of the patient's inability to flex the elbow, but nothing amiss was found. The wound was closed. Manipulations of the finger-, wrist,- and shoulder-joints were now carried out until satisfactory passive motion was obtained. The wounds were dressed, the wrist supported in extension by a cock-up splint, and a sling was applied to the forearm and hand, suspending the latter from the neck. Course of electric applications ordered.

Postoperative Notes (October 25, 1922—seven days after operation).—Wounds exposed; sutures removed; healing *per primam* throughout.

December 22, 1922 (two months after operation): Letter from Dr. Means: "With regard to S——, I am sorry to say I can detect very little improvement. The drop-wrist is still present, and the extensors of the wrist and fingers are more atrophied. The biceps refuses to function and the shoulder-girdle shows atrophic changes. However, the arrival of the electric apparatus, which I believe so essential in his case, has been delayed, due to reasons beyond my control. I feel that after I have used this apparatus on him for several months there will be a noticeable improvement."

January 16, 1923 (three months after operation): Note from Dr. Means: "I have been using the electric apparatus for several weeks now, and already there is noticeable improvement in the nutrition of the muscles of the shoulder-girdle and forearm, in that they are filling out markedly. The patient has as yet no voluntary control of extension of the fingers or the wrist, or of flexion of the forearm."

Comments.—This man was fortunate in that the entire upper extremity was not avulsed. The nature of the trauma was such as to exert a crushing force, but traction as well; as the result of the former the musculospiral nerve was caught between the vulnerating agent and the bone and severely injured; while the traction resulted in a partial stretching of the brachial plexus, especially involving the musculocutaneous nerve, thus accounting for the patient's inability to flex the forearm through the action of either of the flexor muscles. The median and ulnar nerves underwent a mild degree of compression and recovered themselves within a reasonably short time. The musculospiral nerve was severely compressed not only by the initial trauma, but by the subsequent formation of scar tissue. At the operation it was difficult to determine whether or not to resect the neuroma and perform end-to-end union of the nerve ends, so we decided to rest content with the measures that were adopted, reserving the more radical procedure until the postoperative recovery or non-recovery of the nerve was evident.

A whole mass of literature has accumulated from experience with war wounds of nerves, and some remarkable results of primary suture have been reported. Thus, Wirth[1] records a case in which a median nerve completely severed by a piece of glass was sutured at once. In two days there was distinct improvement in some of the movements controlled by the median nerve, *e. g.*, better flexion at wrist, much better pronation, less impairment of opposition, and in abduction of thumb. There was, however, still inability to flex the terminal phalanges of thumb and index. In six weeks almost complete return of normal muscle power was evident, the grip, however, remaining somewhat weak. Sensation showed little improvement. Two months after injury trophic changes were noticed in the thumb, index-, and middle fingers.

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[1] British Med. Jour., November 26, 1921.

EXHIBITION OF CASES: CASE VI. BONE-BLOCK OF EXTENSION OF FOOT DUE TO FRACTURE OF ASTRAGALUS

H. S., MALE, aged twenty-five, elevator constructor, was referred to us on December 10, 1922 by Dr. A. S. Ross, Chief of the New Jersey Rehabilitation Clinic, Camden, New Jersey, for an estimate of the degree of disability. On June 14, 1922 a chain broke in the elevator shaft, and the patient, who weighs 222 pounds, fell a distance of 42 feet, landing mainly on his feet. He was taken to a hospital, where he remained about two weeks.

Physical examination of the patient as he walks into the office shows that the right foot is held in a semi-equinus position. With shoes removed and both feet on a chair it is evident that the right foot is held in a greater degree of flexion than the left. The patient is unable actively to extend the foot beyond this degree, nor can the degree of extension be decreased by passive manipulations. Motion in Chopart's joint is normal in extent. The tendo achillis is taut. The skiagram (Fig. 64) reveals a vertical fracture of the astragalus just behind its middle, with depression of the posterior fragment about $\frac{1}{8}$ inch. As the result of this depression the anterior fragment is left abutting against the anterior border of the inferior articular surface of the tibia, thus explaining the semi-equinus position of the foot and the inability of the patient to overcome it. The skiagram of the left foot shows an oblique fracture of the posterior portion of the lower end of the tibia, but with union in good position.

Comments.—This patient fell a distance of 42 feet, landing with his 222 pounds on both feet on a concrete basement floor, receiving in the right foot a fracture of the astragalus, and in the left a fracture of the lower extremity of the tibia, a difference that is doubtless due to the positions the feet were in when the patient landed upon them, the right heel being nearer the ground than the left. The common result of such a fall is an impacted fracture of the os calcis.

As to the treatment, the obvious procedure is arthrotomy of the ankle-joint, shaving down the upper surface of the anterior fragment to the level of that of the posterior fragment of the astragalus, thus relieving the bone-block and permitting extension of the foot upon the leg. The whole astragalus, even, could be removed with the promise of excellent function resulting. Should the operation be unduly postponed it may not be possible—even though the bone-block be removed—to extend the foot without performing, in addition, Z-shaped division of the tendo achillis. Such a tenotomy, however, would delay the early institution of active and passive motion after

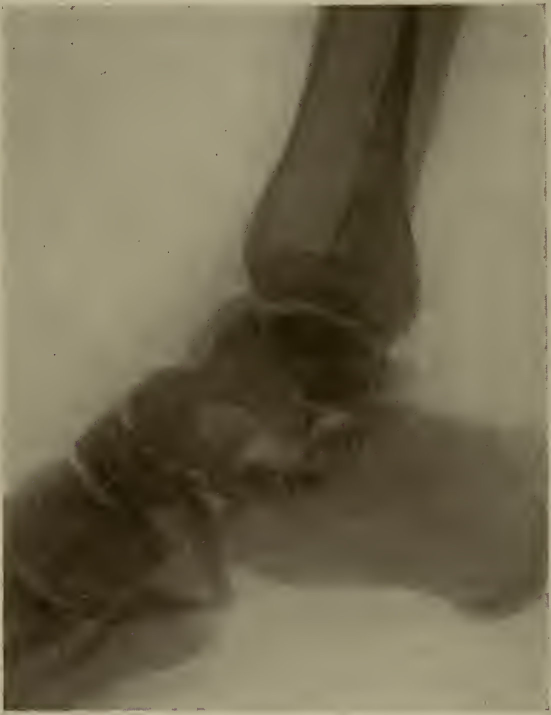

Fig. 64.—Fracture of astragalus showing the deformity that blocks extension of the foot on the leg.

the arthrotomy—a measure that is so essential in rapidly restoring motion in these cases.

As to the amount of permanent and total disability, a 40 per cent. estimate was made, based upon the present condition of the feet without treatment, upon the patient's great weight, and upon his ability to earn a livelihood by any vocation that he might be able to take up. With operative and other measures this disability could probably be reduced to less than 25 per cent. He was awarded 45 per cent.

CASE VII. MULTIPLE CHONDROMATA OF HAND: SARCOMATOUS DEGENERATION (?) OF ONE CHONDROMA

G. H., male, aged seventeen years, was referred to us for consultation on January 8, 1923, by Dr. W. Horace Means, of Lebanon, Pennsylvania. The patient complained of swellings of the middle and fifth metacarpal bones of the right hand, which have been present since infancy. The swelling of the fifth metacarpal bone has increased rapidly in size of late. The skiagram (Fig. 65) at once shows the conditions present. Irregular shadows are seen in some of the phalanges, and corticomedullary changes in some of the metacarpals. It is the fifth metacarpal, however, which, because of its rapid increase in size of late, has brought the patient to the surgeon for relief.

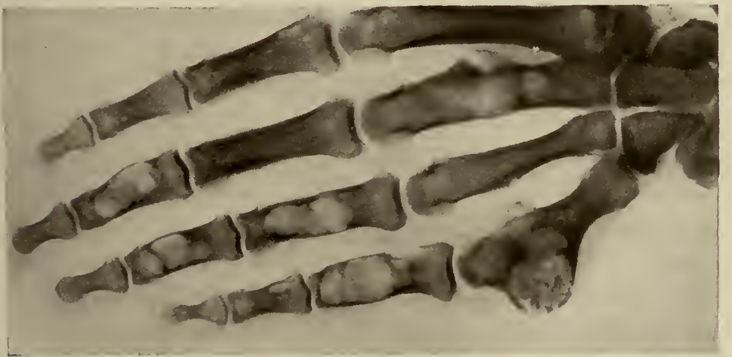

Fig. 65.—Multiple chondromata of hand. The tumor involving the fifth metacarpal is suspiciously malignant.

Comments.—Chondromata are frequently situated in the metacarpal bones and phalanges of the hand, where they are usually multiple and arise from the medulla. They are very likely congenital in origin.

What to do in the case before us is fairly obvious. The largest and most troublesome tumor is that involving the fifth metacarpal bone. Of the five metacarpals in the hand, the fifth, situated as it is at the ulnar border, is the one most exposed to trauma. The patient states that the swelling of the fifth metacarpal has rapidly increased in size of late. That means that it has no doubt been traumatized and at once suggests malignant transformation into chondro-osteosarcoma. Such a case involving the index-finger was reported in this publication by G. P. Muller.[1] It is, therefore, urgently incumbent upon us to advise disarticulation of the fifth digit at the carpometacarpal joint. The patient would be much safer without this very suspicious tumor and when using the hand would hardly miss the little finger. After removal of this digit its neoplasms could be examined histologically—that of the metacarpal to determine the presence of malignant transformation, and that of the proximal phalanx to fix the character of the neoplasms of the other digits. We do not consider it wise in these cases to remove a portion of the tumor for microscopic examination for fear of stirring up metastases; in this case in particular the tumor of the fifth metacarpal has reacted to recent trauma by rapidly increasing in size, and the added trauma involved in removing a specimen may release a horde of malignant cells to run amuck in the body. The skiagram, too, shows that the cortical shell of this tumor is almost broken through at one spot. The tumor involving the third metacarpal does not look active, nor is it exposed to trauma like that of the fifth. As for these remaining neoplasms, a watchful waiting policy should be adopted, as it is not unlikely that their growth will be checked and even that they will undergo involution with the cessation of the metabolic activity of the cartilages further along in this young man's adolescence.

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[1] Surgical Clinics of North America, vol. 2, No. 1, February, 1922, pp. 161–168.

CLINIC OF DR. ARTHUR E. BILLINGS

Pennsylvania Hospital

CASE I. PERFORATED DUODENAL ULCER

The first case we are operating upon this morning is that of a woman fifty-two years of age. She is married and was admitted with the diagnosis of gall-bladder disease, and presents the following history:

Patient states that she was relatively well until December 5th, when she was seized with sudden severe pain in the epigastrium and right hypocondrium, radiating occasionally to the right shoulder. She states that she has been slightly jaundiced on several occasions, but never markedly so at any time. She eructates much gas, has frequent attacks of heartburn with indigestion, and is chronically constipated. She does not associate pain directly with the taking of food, has vomited three or four times each day since the onset of her acute trouble, and complains of anorexia, vertigo and dyspnea on exertion. She states that she has had many attacks similar to this one since 1916, but never so severe in character. Prior to that date she had suffered from flatulent dyspepsia and right upper abdominal pain at irregular and longer intervals. She has been married for thirty years, has had 8 children, 7 of whom are living and well; 1 died of meningitis. There is no history of miscarriages or abortions. Menstruation began at seventeen years of age, was always regular and normal in character until her menopause eight years ago. No history of tuberculosis or malignancy in family.

She has been in the hospital for five days and was slightly febrile until yesterday, her temperature ranging between 100° F. and normal. Blood examination: Hemoglobin, 95 per cent.; red blood-cells, 4,870,000; leukocytes yesterday were 11,200.

Urine negative except for a trace of albumin and many pus-cells on first examination, but three subsequent examinations were negative. There is no evidence of bile in the urine, nor has she ever had any urinary symptoms, and she has not been jaundiced since admission to the hospital. There is nothing worthy of note in her physical examination other than that of the abdomen and heart. She presents the characteristic signs of a fairly well compensated aortic regurgitation. She has a Corrigan pulse with a slight presystolic thrill at the apex. The second sound at the aortic area is soft, short, and blowing in quality. The second pulmonic and second apical sounds are doubled. The abdomen is tender and moderately rigid over the whole of the upper quadrant. There is an easily palpable mass in the region of the gall-bladder. We have not subjected her to a gastro-intestinal *x*-ray study because of the acuteness of her symptoms. We do not feel certain as to the diagnosis in this case. Her symptoms will fit pretty well into the clinical picture of a chronic gall-bladder disease, complicated by an acute hydrops or empyema of that viscus. I think we can eliminate the possibility of acute renal or perirenal infection. The presence of a duodenal or pyloric ulcer with a slow leak is a strong probability in the differential diagnosis, and I feel cannot be excluded without *x*-ray study, but her history is more suggestive of cholecystitis. There is no history of a previous typhoid or influenzal infection which we always regard as an important factor in the etiology of gall-bladder disease.

In view of the patient's cardiac condition ether is certainly the anesthetic of choice, and preliminary to her anesthesia she was given $\frac{1}{4}$ gr. of morphin sulphate and 1/150 gr. of atropin hypodermically.

We give routinely to adults the hypodermic of morphin and atropin half an hour before anesthesia, no matter what the anesthetic is to be. We are convinced that it induces a more receptive mental attitude on the part of the patient, that it lessens the amount of anesthetic necessary, that it gives a more even and agreeable anesthesia, and reaction is less unpleasant and more placid.

The field of operation has been prepared with tincture of iodin (pharmacopeal strength) and then washed with 95 per cent. alcohol. This patient is a short square-chested individual with a wide intercostal angle and a thick abdominal wall. We will open the abdomen through the transverse incision as described by Moschowitz, which I think in this type of case gives a better exposure than vertical incision. It is certainly more easily closed, and I do not believe there is any more danger of hernia after its use if a careful and accurate anatomic apposition is obtained in its closure. The diagnosis is a walled-off perforated duodenal ulcer rather than an acute infection of the gall-bladder. There is a large indurated ulcer just beyond the pylorus in which there has been a small perforation surrounded with considerable plastic exudate and no generalized extravasation of contents. There is no evidence of gall-stones or gall-bladder or duct involvement other than that of a pericystic inflammation, which would be readily accounted for in such a closely related process. We will invert the ulcer with a series of broad imbricating mattress-sutures of linen thread which will obstruct fairly completely for a time the food carried over the ulcerated area, and will help to divert it through the new opening in the stomach made by doing a no-loop posterior gastrojejunostomy, and we believe that it is an essential step in the successful treatment of these lesions. We make this a part of the routine procedure except in the late cases where the patient's condition is *in extremis.* In these cases where peritonitis is diffuse haste is imperative and nothing more than closure of the perforation with drainage should be attempted. Where there has been much extravasation of duodenal or gastric contents and peritonitis is marked, drainage should be gained through a suprapubic stab-wound with a rubber-covered gauze drain, or a soft-rubber tube leading into the pelvic pouch with or without a rubber-covered gauze drain through the operative incision. If this is indicated, care must be observed in placing the drain away from the closed perforation for fear of inviting subsequent leakage. In this case drainage is not indicated. Our anastomosis is completed and you will observe that by the no-loop operation we mean that the jejunum is caught as closely to the ligament of Treitz as is possible without causing tension at the site of anastomosis, which is isoperistaltic. Strictly speaking, there are perhaps, 2 or 3 inches of jejunum proximal to the stoma. The opening in the gastrocolic omentum has been sutured with interrupted sutures of catgut to the gastric wall ½ inch away from the line of anastomosis. This precludes the possibility of hernia into the *lesser* peritoneal cavity. The after-treatment of this patient will consist in placing her in the Fowler position and giving continuous enteroclysis of 5 per cent. solution of glucose and 2 per cent. bicarbonate of soda. Small quantities of water by mouth will be given at the end of twenty-four hours if nausea has ceased, and after forty-eight hours plain albumin-water (without orange or other fruit juice), and on the fourth to the seventh day peptonized milk, junket, custard and soft eggs, with a full soft diet from the tenth to the fourteenth day. During the first forty-eight hours after operation morphin will be given in sufficient dosage to relieve her of pain and to induce a fair amount of sleep. If there are no symptoms to indicate an earlier inspection her wound will be dressed on the ninth or tenth day, when the stitches will be removed. Hot water should be given freely when the patient has begun to take soft and solid food, a glass half an hour before and one or two hours after feedings is distinctly advantageous in preventing regurgitation and discomfort and encourages a more prompt emptying of the stomach. The upright position after meals also facilitates this just as does the Fowler position immediately after operation. The hyperacid tendency on the part of these patients is first met with an easily digested, high protein diet, given at frequent feedings, and, if this is not sufficient, alkalies are added. A strict diet must be adhered to for six to twelve months at least. Most of these patients are constipated, and it is very important to overcome or avoid this condition, as it is frequently responsible for regurgitation and distress during their convalescence before they have had a chance to become adjusted to the new physiology of their digestive mechanism.

We are apt to pay too little attention to the postoperative treatment of these cases. Many of them who have had a skilfully performed operation have continued trouble, or, if relieved of symptoms for a time, have them recur later because both surgeon and patient have been neglectful in carrying out the proper dietetic and hygienic régime necessary to complete recovery. A long convalescence in this respect is necessary, and these patients, as soon as they begin to feel comparatively well after operation (which they soon will), then become careless and commit dietetic indiscretions with the usual unhappy result, and in many cases all because they have not been instructed how to intelligently care for themselves, or have not been sufficiently impressed with the importance of it. The operation is only a part of the treatment and after the patient has recovered from it, he is better for being in the care of an experienced gastro-enterologist for the after-management.

CASE II. ACUTE CHOLECYSTITIS—CHOLELITHIASIS

THE second case is that of a married woman thirty-five years of age whose chief complaint on admission was pain in the right upper abdomen. She does not remember having had any serious illness and has never had an operation. Since 1919 she has had attacks of indigestion manifested by discomfort in the epigastrium (not real pain), constipation, headache, gaseous, sour and bitter eructations, usually accompanied by nausea and vomiting, with relief. These attacks have occurred about two or three months apart. Her present illness began two weeks ago with acute intermittent pain over the whole of the upper abdomen with much gaseous eructation. She was constipated and took a saline cathartic and felt better on the following day, resuming her work. Twenty-four hours later she was seized with more severe pain, which was colicky in character. At this time she was much nauseated and vomited several times. The pain became localized to the right upper quadrant. She did not notice any jaundice prior to her admission to the hospital. There is nothing of significance in her social or family history. On admission to the hospital her temperature was 100° F., pulse, 100, and respirations 26. She was slightly but definitely jaundiced. Urine was negative except for a trace of bile. Blood: Hemoglobin 80 per cent., red blood-cells, 3,750,000, leukocytes 12,800, coagulation time three minutes. There were no abnormal findings in her physical examination except in the abdomen, which was distinctly tender and rigid over the whole of the right upper quadrant with a rounded smooth mass which moved with respirations and was easily palpable. We felt that this mass was an acutely inflamed distended gall-bladder, and if she were kept quietly in bed with heat or ice over the abdomen, with enough morphin hypodermically to relieve her of pain, continuous enteroclysis and little or no fluid by mouth, the attack would subside.

With the liver above, the transverse colon below, the peritoneum in front, and the omentum ever ready for protective mobilization, the anatomic position of the gall-bladder is such as to almost always insure a localization of any inflammatory process of which it may be a victim. Occasionally rupture of the gall-bladder ensues where suppuration has occurred, but in this event, no general contamination of the peritoneum takes place, and a walled-off abscess is the usual result. Rarely, a fistula into the duodenum or transverse colon is formed with discharge of its contents into the intestinal tract. An abatement of the acute symptoms may then generally be expected and our remedial measures before operation are directed toward this accomplishment. Her temperature remained about 100° F. for the first twenty-four hours after admission, then became higher, ranging between 102° and 103° F. for thirty-six hours, but gradually getting to normal on the fifth day after admission. During this period her tenderness became more acute and her jaundice more marked, but her coagulation time had not increased. Her temperature has been normal for the past thirty-six hours and the leukocyte count is 12,600, practically the same as on admission. Her history and symptoms are quite characteristic of gall-bladder disease. She has had a gradually increasing flatulent dyspepsia without any regular grouping of symptoms, manifested cheifly by weight or oppression in the epigastrium with gaseous, acid, and sometimes bitter eructations. Nausea and vomiting at the height of her discomfort have been conspicuous symptoms and have always given relief. Until the onset of this acute attack she had not complained of pain notwithstanding a distressing dyspepsia of three years' duration. This is the typical course of progression in the development of chronic gall-bladder disease. Then suddenly with the development of an acute cholecystitis or the passage or lodgment of a stone in the ducts, these patients are seized with a sudden violent right upper abdominal pain, unlike any they have ever had before. It usually radiates to the back or right shoulder, sometimes to the left, and requires morphin hypodermically for its relief. It is colicky in character and lasts for a variable length of time, ordinarily from a few minutes to several hours. The temperature is apt to become elevated, but during the intensity of the attack the patient may actually be in a state of shock. The pain of gall-bladder disease is usually a late symptom and means the presence of stone or an acute exacerbation on a chronic inflammation. In duodenal ulcer, pain is an early and the most prominent symptom, and in 8 out of every 10 cases we find that there is a definite time relationship between the taking of food and the onset of pain. There is also a distinct periodicity as to the occurrence of the symptoms in ulcer. The symptomatology of gall-bladder disease is without order and in its earlier phases is as insidious as it is inconsequent, flatulency being its most constant manifestation. This patient has a rather oblique costal margin with a narrow intercostal angle and we will open the abdomen through a vertical right rectus incision. On inspection we find that the gall-bladder is obscured from view by adherent omentum and transverse colon which is the result of a recent inflammation. We will protect the rest of the peritoneum and viscera by thoroughly walling off with gauze packs. There is no evidence of gastric or duodenal ulcer. The adhesions are quite easily separated, the gall-bladder is enlarged, tense and inflamed, and contains many stones. There is a stone in the common duct at its juncture with the cystic duct. The pancreas is about normal in size and does not seem abnormally hard. The question now arises as to whether we shall do a cholecystectomy or a cholecystostomy. In view of the rather severe infection, obstruction of the common duct, a fairly deep jaundice and cholangitis to a greater or lesser degree, removal of the stones with drainage of the gall-bladder would seem to be the advisable procedure. The gall-bladder is grasped with two Allis' forceps and the fluid is aspirated with a trocar to prevent soiling when it is opened. We will culture the bile, which is very thick, dark, and purulent; a section of the gall-bladder will also be taken for pathologic and bacteriologic study. In many of these cases organisms are recovered from the mucous membrane or tissue of the gall-bladder when cultures from the bile and stones are negative. Streptococci, staphylococci, colon bacilli, and typhoid bacilli are the organisms usually found, and in many instances are the nidus upon which stone formation begins. After removal of the other stones the one in the common duct was removed through the cystic duct which is considerably dilated by the large stone impacted in it. Drainage will be obtained through a rather large rubber tube anchored within the gall-bladder with chromic gut No. 1 after we have secured a water-tight inversion of the cut edges of the gall-bladder around the tube. Irrigation of the gall-bladder is then done with normal salt solution for the purpose of removing the blood-clot and débris, proving the patency of the tube, and the tightness of the closure around the tube. A small rubber-covered gauze drain is also placed alongside the tube into the gall-bladder fossa. The wound will be closed in layers around the tube and rubber drain, both being fixed in position with skin sutures. The after-treatment will consist in giving enough morphin to relieve her of pain, and enteroclysis continuously, until she can take a sufficient quantity of fluid by mouth. The rubber-covered drain will be removed on the third day and the tube will be kept in place for at least two weeks and possibly longer, depending upon how quickly her bile becomes normal in character. If bleeding or persistent oozing should occur we will give her an intravenous infusion of 0.2 per cent. calcium lactate solution or 15 c.c. of horse-serum subcutaneously.

CASE III. ACUTE OSTEOMYELITIS

The next 3 patients that I wish to show you are cases of acute osteomyelitis, all having been operated upon. I am presenting them because each of them has manifested a different type of infection, and each of them has had complications which have added to their surgical interest, all representing different phases in a disease which is full of interesting and distressing clinical and pathologic possibilities.

The first of these cases of osteomyelitis is a boy eight years of age who was admitted to the hospital on June 17, 1921. His chief complaint on admission was pain in the left leg.

Family History.—Mother died of appendicitis at thirty years of age. Father is living and well. Three sisters and one brother are living and well. Three sisters are dead, one of whooping-cough; the cause is unknown for the death of the other two. No history of malignancy or tuberculosis in family.

Past Medical History.—He had pneumonia with influenza in 1918. On March 29, 1921 he was admitted to this hospital for tonsillectomy with the diagnosis of hypertrophied tonsils and adenoids. Previous to that date he had had several attacks of tonsillitis and had complained of pain in the right knee. His general physical examination preparatory to tonsillectomy did not reveal anything abnormal except for what he was admitted. His tonsils and adenoids were removed on March 29, 1921, and he was allowed to go home on March 30, 1921—discharged in good condition. On the following day after his discharge from the hospital he developed pain in the left knee and could not walk. The next day the right knee became painful, and on April 2d both knees became swollen and more painful, and he was admitted to this hospital again April 6, 1921, with both knees painful, tender, warm, slightly reddened, swollen, and slightly fluctuating. Physical examination otherwise was negative except for slight tenderness over right lower quadrant of abdomen and sore throat. There was no evidence of other involvement. His temperature at this time was 102° F., pulse 116. There were 13,100 leukocytes. The left knee-joint was aspirated at the time of admission, fluid was obtained, but no organisms were found on smear or culture. The temperature went up to 103.4° F. on the next day, but on the fifth day after admission his temperature had become normal and remained so during the remainder of his stay in the hospital. The swelling of the joints rapidly disappeared and he was discharged as well on April 20, 1921, with the diagnosis of acute rheumatic fever. His urine showed a few white blood-cells on admission and discharge, but was otherwise negative. He remained well after he left the hospital until June 15, 1921, when he developed severe pain in the left leg. This became worse and he could not walk. He vomited before the onset of pain, but attributed this to overeating. On admission to the hospital June 17, 1921 he did not complain of any symptoms referable to the gastro-intestinal or genito-urinary tracts, the circulatory, respiratory, or nervous systems. His temperature was 104° F., pulse 136, respirations 28. The left leg was markedly swollen, reddened, painful, and tender; no evidence of effusion in the knee-joint, no other joints involved, and extremities otherwise normal. There is no evidence of fracture or injury and physical examination is otherwise negative.

Urinalysis.—Amber, acid, 1028, cloud of albumin, sugar negative. Microscopic: Casts (2 hyaline), red blood-cells 0, white blood-cells 2 per field, few urates, few phosphates.

Blood Examination.—Leukocytes 28,800; differential count: polys. 87 per cent, small lymphocytes 9, large lymphocytes 3, transitionals 1, eosinophils 0, basophils 0.

The diagnosis of acute osteomyelitis of the left tibia was made, and soon after admission, under nitrous oxid anesthesia, he was operated upon by Dr. Edward Klopp. After the field had been prepared with tincture of iodin and alcohol, and incision internal to anterior border of tibia was made, liberating a marked accumulation of pus from beneath the skin and periosteum, the latter having been detached for some distance below the upper epiphysis. The medullary cavity was then opened through a channel made in the shaft with a chisel. Pus was found in the medullary cavity. There did not seem to be any marked destruction of the epiphysis. A number of Carrel tubes were placed in the medullary cavity for subsequent irrigation with Dakin's solution. Reaction after operation was satisfactory. Culture obtained from pus at operation showed pure culture of Staphylococcus aureus. His temperature for the first few days after operation ranged between 100° to 105° F. until the fourth day after, when it settled down to 101° to 102° F. This continued until July 13th, when we operated upon him under nitrous oxid anesthesia for involvement of the lower end of the left femur through an incision above the inner condyle from which pus was obtained. The incision over the tibia was then extended, and a large sequestrum, which included the entire length of the shaft between upper and lower epiphysis, was enucleated (Figs. 66, 67). The upper epiphysis looked to have been entirely destroyed with a considerable portion of the articular surface of the tibia, leaving the knee-joint open on its inferior surface. Carrel tubes were placed in the cavity for sterilization with Dakin's solution, which was followed with the usual technic. His temperature then gradually got lower, but persisted between 99° to 100° F. We were unable to obtain a growth on blood-culture. There was considerable swelling of the left knee-joint. On August 3d an exploring needle was introduced into the joint cavity under gas anesthesia, but no fluid was obtained. It was assumed that the joint swelling was due to arthritis without suppuration. He continued to progress fairly satisfactorily, temperature gradually getting a little lower, remaining below 100° F. most of the time. During this period his urine on repeated examination was negative except on two occasions, when a few pus-cells (2 or 3 to a field) were reported. He also had during the height of his febrile period a few hyaline casts reported on one occasion. He had not complained of any urinary symptoms up to this time. On October 11th, which was one hundred and ninteen days after his admission, he complained of sudden severe pain in the left upper abdomen and back.

He had a sharp rise in temperature (103° F.), with marked tenderness over the left kidney in front and behind, with considerable muscular rigidity. His temperature persisted around 103° to 104° F. for five days, gradually getting down to about 100° F. again. During this period he developed frequency of urination with pain referred to the genitalia on micturation. Blood-culture was again negative. We were uncertain as to

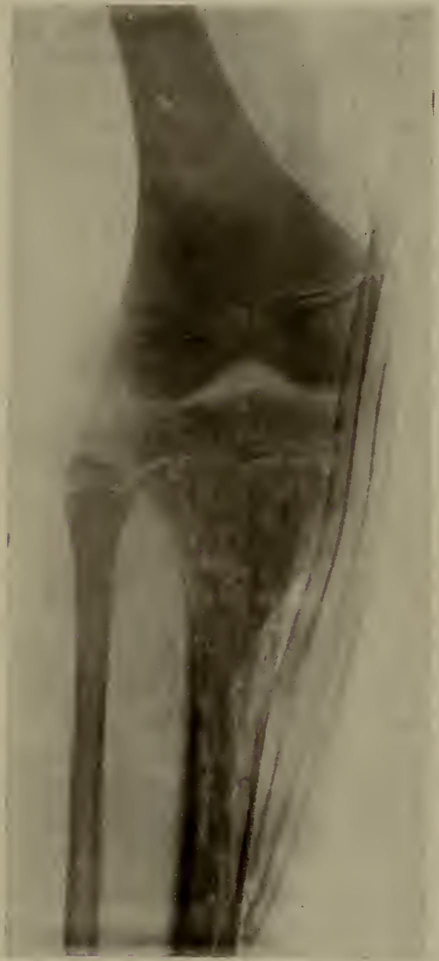

Fig. 66.—Case III. Showing involvement of tibia and upper epiphysis.

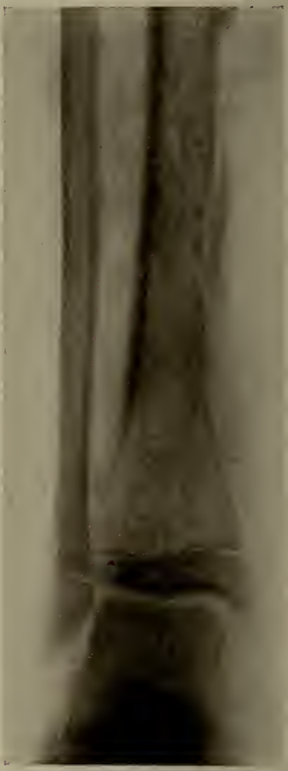

Fig. 67.—Case III. Same time, showing involvement of lower half.

whether he was suffering from acute pyelitis or had an infarct with a beginning pyonephrosis. As his temperature subsided his pain and tenderness decreased. Two weeks after the onset of this complication all pain had disappeared and there was very little or no tenderness, and the kidney was not palpable. The urine, however, was loaded with pus. He has had a mild pyuria

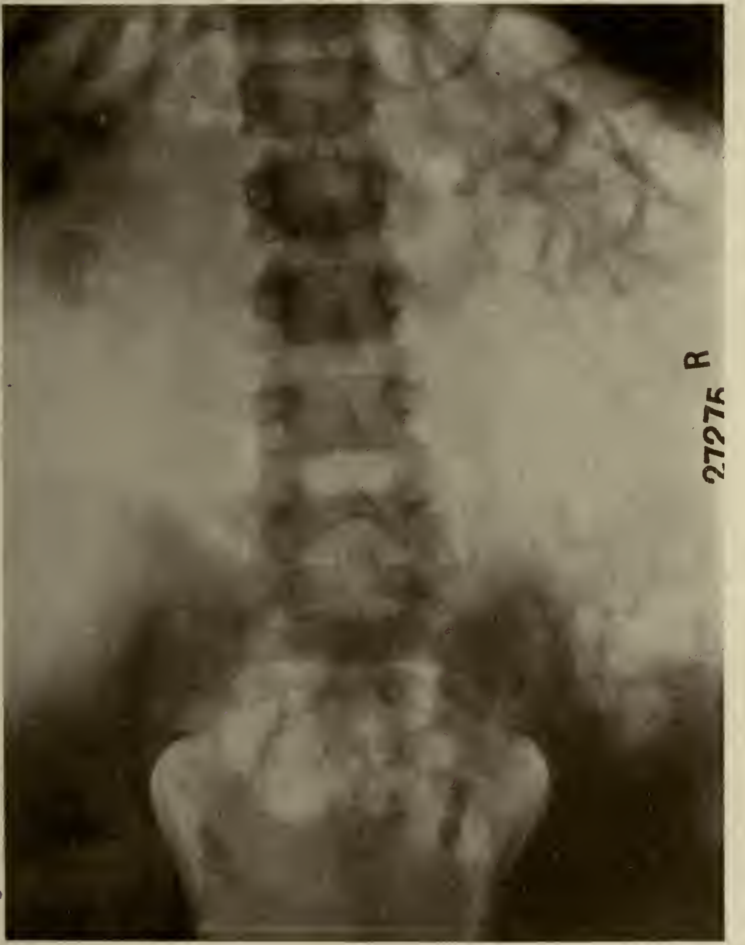

Fig. 68.—Case III. Showing calculi in lower end of both ureters and left calcareous kidney.

ever since, which has lessened very much during the past six weeks. On x-ray examination of his genito-urinary tract we found a very interesting condition (Fig. 68). The region of the left kidney is the seat of shadows which would ordinarily be interpreted as a calcareous or tuberculous kidney. In addition to this, his first plates showed some very interesting shadows about the lower end of each ureter. Dr. Bowen, to whom we are much indebted for the careful x-ray studies of this patient, did not feel certain as to the nature of these shadows. At first there were three conditions to be considered in their interpretation: the shadow in the region of the left kidney might ordinarily be interpreted as tuberculous, in which condition it would be easy to assume that the pelvic shadows were calcified tubercular glands. Phlebosclerosis was another consideration, and, of course, stones in both ureters was the other. The left side showed four shadows and the right side three. On both sides they seemed to be superimposed one upon the other. We then felt that a cystoscopic examination with ureteral catheterization should be done. The boy is only eight years of age and it was difficult to get a cystoscope into the bladder, and we are indebted to Dr. Leon Herman for a very skilful and satisfactory ureteral and bladder study. On catherterization of the left ureter with a No. 15 French single catheterizing scope he was unable to obtain any urine. The patient was then given an intravenous injection of indigocarmin which did not appear from the left ureter after twenty-five minutes' observation. He did not encounter any obstruction in the left ureter and after irrigation through the catheter only enough fluid from lavage was obtained for culture. On the right side there seemed to be definite obstruction just above the ureteral opening, but the catheter was passed after difficulty and there was a slight delay in function, the indigocarmin appearing six minutes after injection. The function for the first hour was 20 per cent. and for the second hour 15 per cent., giving a total function of 35 per cent. for the two hours. A pure culture of staphylococcus was obtained from the right, with no growth reported on culture from the left. The day following the ureteral catheterization he was seized with severe colicky pain attended with nausea, vomiting, urinary difficulty, and the passage of a stone. You will observe in the *x*-ray plates the changed relationship in the shadows, all shadows on the right side having disappeared, while those on the left side are unchanged in position (Fig. 69). In addition to this complication, he has had an insidious infection in the neck of his right femur, of which he has never complained, and which he has never ceased to use. He has depended on the right leg to the full exclusion of the left in changing his position in bed. You will observe that although his movements are somewhat restricted, there is no marked limitation in any direction. He does not complain of pain on movement, and will not admit

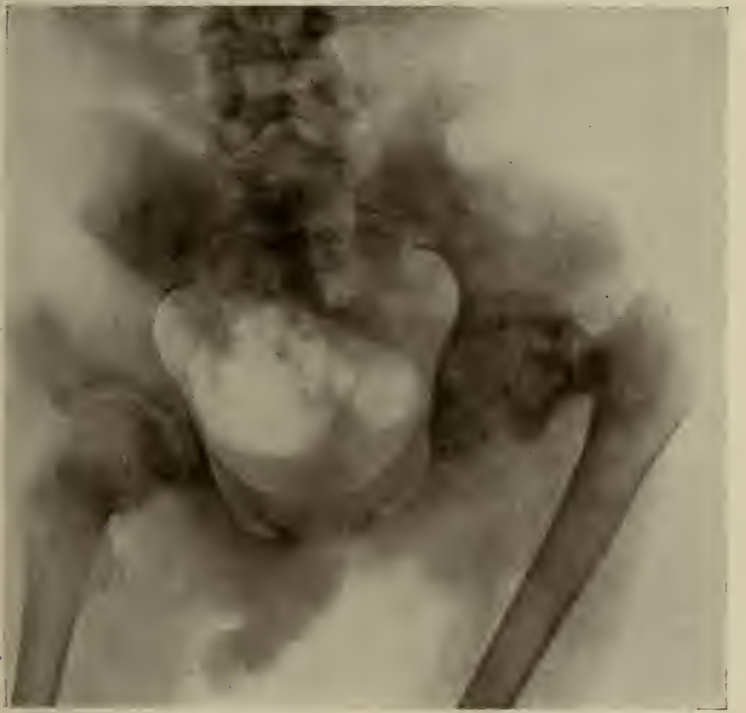

Fig. 69.—Case III. Shows osteomyelitis of neck of right femur (non-suppurative)—ureter calculi having been passed after cystoscopy before this exposure was made.

that he has ever had pain in the right hip during his stay in the hospital. You will see that he has some deformity with elevation of the great trochanter. This is confirmed by *x*-ray, which shows almost a total destruction of the head and neck with a pathologic fracture, resulting in a pseudo-arthritis. We did not recognize this condition until the damage had been done.

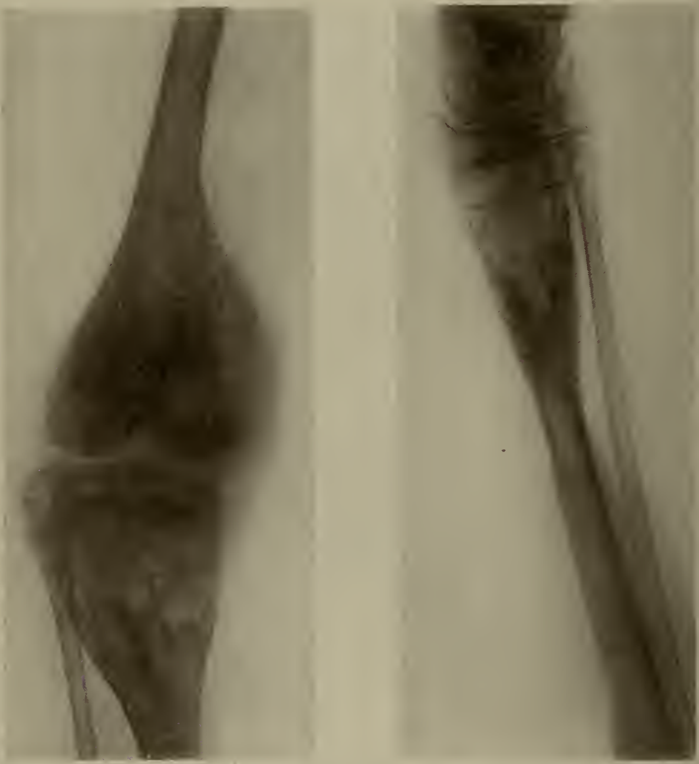

Fig. 70.—Case III. Showing bone regeneration in both tibia and femur sixteen months after operation.

I feel confident that it is a part of the same infection that he is suffering elsewhere, and that he has had a generalized blood infection notwithstanding the fact that repeated blood-cultures have always been negative. The wounds of the left leg have been entirely healed for several weeks, and you will see from the *x*-ray and appearance of his leg that he has had a rapid and abundant regeneration of new bone (Figs. 70, 71). The removal of the very large sequestrum enabled us to sterilize the cavity of the involucrum more quickly than we could have otherwise. Caution must be observed lest it be done too soon. I mean by this before it has acquired sufficient rigidity to maintain the contour of the extremity. This is most important in the growing child where there is involvement of femur or humerus. If epiphyseal invasion has occurred, a disproportion in the growth of the tibia and fibula or the ulna and radius is apt to take place, resulting in contracting and unsightly deformities which are very difficult and sometimes impossible to correct.

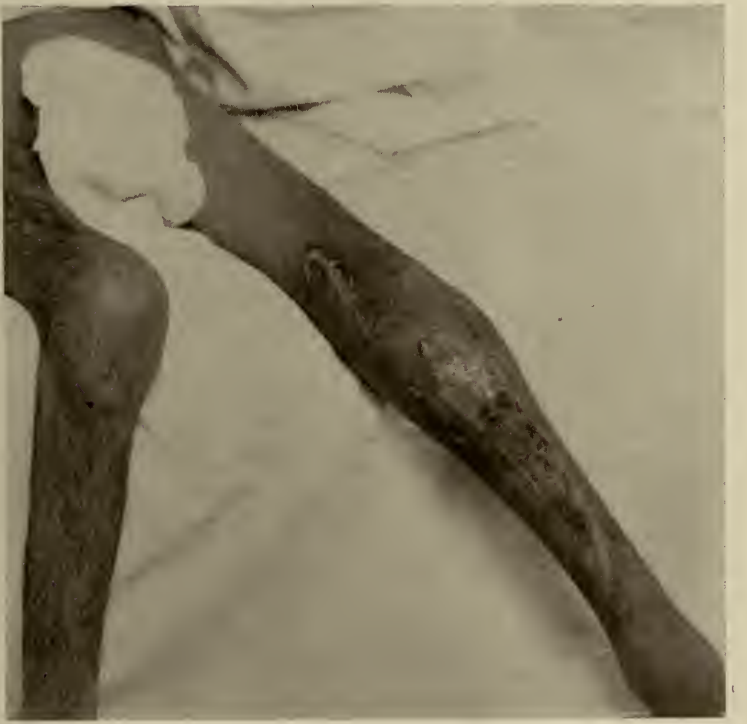
Fig. 71.—Case III. Healed wounds.

CASE IV. ACUTE OSTEOMYELITIS OF RIGHT FEMUR. SUPPURATIVE ARTHRITIS OF RIGHT KNEE-JOINT

The fourth case is that of a man thirty-eight years of age whose family and previous medical history are negative so far as having any bearing on his present illness is concerned. He says that he has never been sick, denies usual diseases incidental to childhood, has never had any operations, no history of trauma. During September and the early part of October, 1921 he was confined to bed for four weeks with influenza. On the third day after he had gotten out of bed he felt pain in the right leg and thigh. This troubled him slightly for two or three days, and then he had a chill, with a profuse sweat and increased pain in the leg. He was admitted to the hospital on October 10th with temperature 101° F., pulse 100, and respirations 38. General physical examination on admission was negative except for tenderness and slight muscular rigidity over the region of the gall-bladder. There was also slight tenderness over the upper third of the right femur on very deep pressure. There was no restriction of movement in any direction and no pain on motion. Urine was negative; blood: hemoglobin, 60 per cent.; red blood-cells, 4,150,000; leukocytes, 21,000. Widal reaction was negative for typhoid and paratyphoid. Blood-culture was negative. Wassermann was negative. Sputum negative for tubercle bacilli. *x*-Ray examination was negative on admission. The patient for the first five days after admission was observed by Dr. McCrae on the Medical Service. He was then transferred to the Surgical Service of Dr. Gibbon, to whom I am indebted for the privilege of operating upon and studying these cases. We then observed him for five days more before operating. In the meantime he had developed more tenderness over the region of the gall-bladder, with definite jaundice and with considerable bile in the urine. During the greater part of this time he did not complain of much pain in his thigh. He had slight tenderness on deep pressure over the upper half of the femur. The leukocyte count was fluctuating around 30,000. His differential count showed 66 per cent. polys., 30 per cent. lymphocytes, 2 per cent. large mononuclears, 2 per cent. transitionals, basophils 0, eosinophils 0. The stools at this time were clay colored and on two attempts at drainage of the bile-ducts through a duodenal tube with the installation of magnesium sulphate into the duodenum, we were unable to recover bile or organisms from culture. During his stay on the Medical Service his temperature was pretty steady, around 102° to 103° F. His pulse-rate during this time was never above 104 and usually 84 to 96. On October 16th his temperature dropped to 99° F. and it did not go above 100° F. for three days. On October 20th, however, it went up to 102.3° F., with an increase in his leukocytosis to 41,600. By this time his jaundice had cleared up and there was only very slight tenderness over the gall-bladder. A second blood-culture was negative, and on *x*-ray examination again there was doubt as to whether or not there was a lesion in the femur. On October 21st we operated under nitrous oxid oxygen and ether anesthesia, which had been preceded with $\frac{1}{4}$ gr. morphin and 1/150 gr. atropin hypodermically half an hour before. The field of operation was prepared with tincture of iodin and alcohol. The entire shaft of the right femur, between the great trochanter and condyles, was exposed through an incision along the outer surface of the thigh. The periosteum was found thickened, but no pus was encountered until the medullary cavity was opened. A trough or gutter was made opening the medullary cavity for its entire length between the great trochanter and base of the condyles. The medullary cavity was everywhere filled with pus and was under considerable pressure, but had not broken through the cortex. Carrel tubes were so placed and fixed within the medullary cavity that its entire surface would be freely irrigated with Dakin's solution. The organism obtained from culture and smear from pus showed a pure culture of the Bacillus mucosus capsulatus. We repeatedly obtained this same organism in pure culture from the wound on subsequent examinations.

The patient was not severely shocked by the operation, and his temperature persisted around 102° F. for the next week. On the fifth day after operation the right knee became very much swollen and painful, with signs of effusion in the joint. This increased, and on the seventh day after operation the joint was aspirated; more than 4 ounces of thick, creamy pus was withdrawn, extension was applied, and ice was kept continuously over the joint, swelling subsided, and effusion did not recur. A culture and smear from this also showed a pure culture of the Bacillus mucosus capsulatus. His temperature, within forty-eight hours after the joint aspiration, had dropped to 100° F., and within two weeks after operation was running 99° to 100° F., and within five weeks was entirely normal and has remained so since. On December 7th we were able to get his cavity sterilized, having obtained three successive negative smears and cultures when we removed the Carrel tubes, allowing the wound to close. This wound surface and the surrounding skin was then kept clean by the application of tincture of iodin, and his wound, as you will observe, has entirely healed over (Fig. 72). His *x*-ray plates show good regeneration of bone and there has not been any sequestrum formation (Fig. 73). *x*-Ray plates of the knee-joint have not shown any evidence of gross bone or cartilaginous involvement. He has marked restriction of movement in the knee-joint, as you will see, but he is steadily overcoming this,

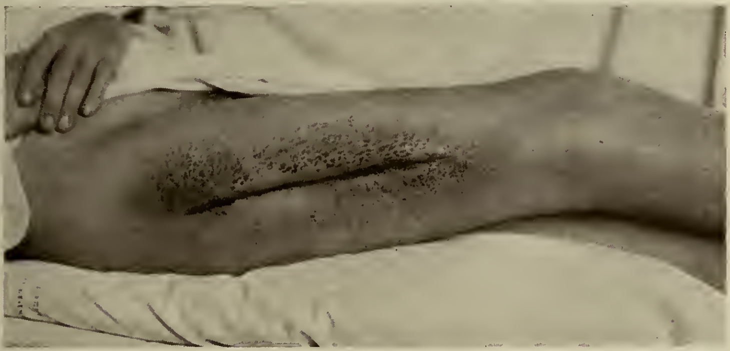

Fig. 72.—Case IV. Healed wound.

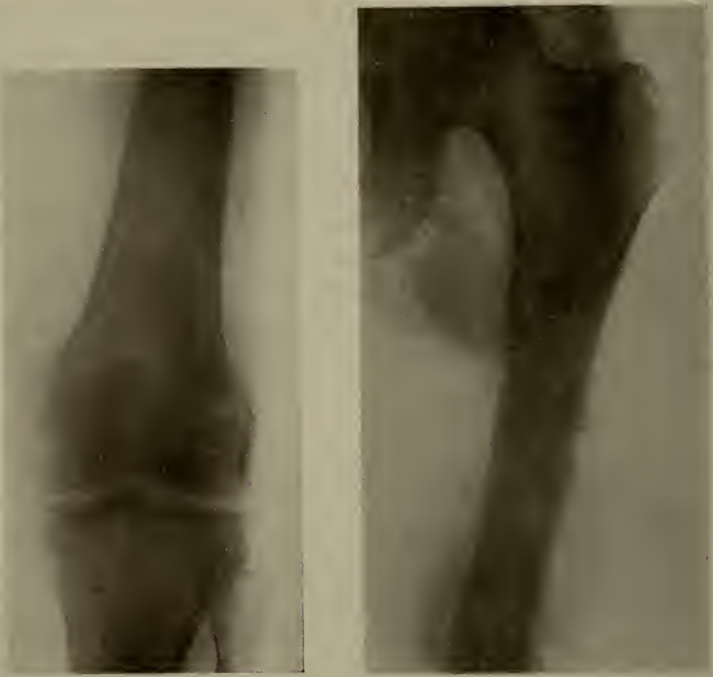

Fig. 73.—Case IV. Showing bone regeneration and normal knee-joint without bone changes three months after operations.

and I feel that he should ultimately get a complete or nearly complete return of function with the aid of massage, movements, etc.

CASE V. RECURRING SUPPURATIVE OSTEOMYELITIS (MULTIPLE)

The fifth case is that of a boy nineteen years of age. He has been an exceedingly interesting case and we have been watching him since June 7, 1917. Dr. Despard and I have each operated on him several times at the Jefferson Hospital. I shall only give you a very brief abstract of his history and progress during his several admissions to the hospital.

There is nothing in his previous personal or family history that relates to his present condition. A few days before the onset of his osteomyelitis he had an abscess in the left side of his neck which was opened in the Out-patient Surgical Department of the Jefferson Hospital. He did not give a history of any antecedent injury. He has had a succession of lesions, beginning with an extensive osteomyelitis of the left humerus which ultimately involved the entire shaft, and which was widely opened, the shaft being guttered from the greater tuberosity to the condyles below. He was very ill with this infection. A pure culture of Staphylococcus pyogenes aureus was recovered from both the medullary cavity of the humerus and the blood-stream. He recuperated fairly rapidly and was discharged from the hospital August 27, 1917 to the Out-patient Department. He was then readmitted a few months later with an osteomyelitis of the right clavicle, for which he was operated upon. His third admission, and third operation, was for an involvement of the left tibia. The next bone to be involved was the shaft of the right humerus. The involvement was not quite as extensive as that of the left arm. He then developed an abscess over the right gluteal region, for which a necrosis of the right ilium was responsible. The next point of involvement was that of the left sacro-iliac joint, which was opened and drained. He then had an osteomyelitis of two ribs in the right chest, with subsequent pleural infection and empyema (Fig. 74). We have always recovered a Staphylococcus pyogenes aureus from his various lesions. We have also recovered this organism from the blood on two occasions more than a year apart. He has always shown a fairly rapid bone regeneration. He has always

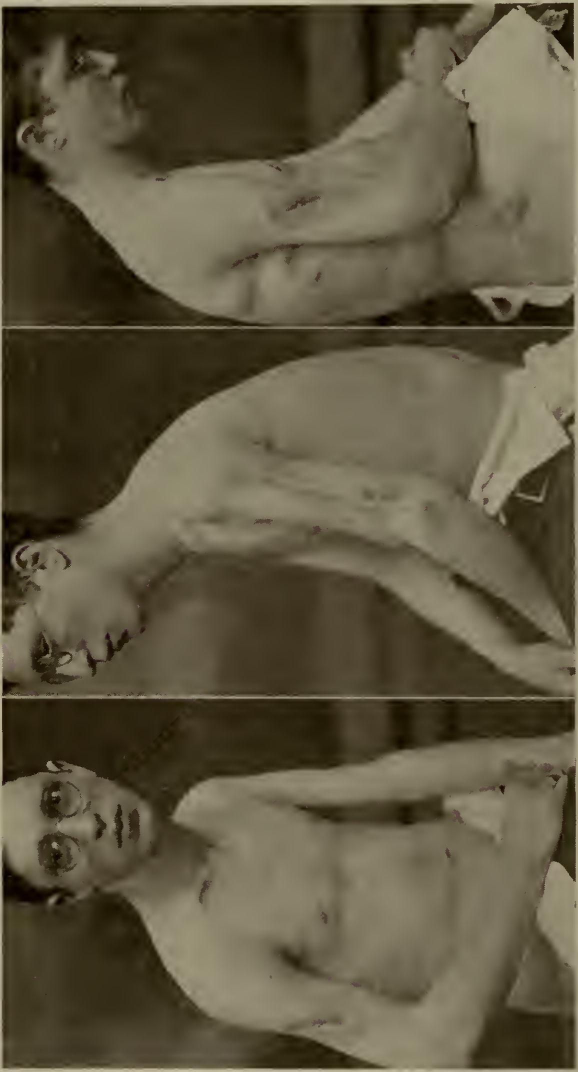

Fig. 74.—Case V. Recurring suppurative osteomyelitis in healed wounds. (Multiple involvement.)

manifested a great deal of difficulty in establishing a complete immunity against this organism, but in spite of the many recurring and severe exacerbations of this infection he has grown and developed about as rapidly as one would have expected had he been in good health for this period of four years. We think he is about well at this time, but we have been misled as to his condition on more than one occasion in the past, and we will continue to keep him under observation until we are certain that recovery is complete. You will observe that he has a completely ankylosed left elbow. He had a recurring infection in the left humerus in the latter part of 1919 and the early part of 1920. At this time the lesion extended into the elbow-joint, resulting in a very destructive arthritis, with a subsequent involvement of the left ulna. This patient is interesting because of the marked chronicity of infection and multiple foci of involvement. The staphylococcus in this case has shown a marked affinity for osseous tissue. During the long period of infection, with many acute and severe exacerbations, he has suffered bone involvement only, with the single exception of empyema, and this we feel was primarily due to osteomyelitis of the ribs, from which he suffered a subsequent pleural invasion.

There are several interesting features exemplified in these 3 cases of osteomyelitis. Case III is interesting because of the genito-urinary complications which have arisen, and the destructive process in the right hip. He, unquestionably, has had a pyelonephritis of the left kidney, which we think must be hematogenous in origin, and has resulted in a complete destruction of that organ so far as function is concerned. The calculi which have been demonstrated in both ureters, we believe, are secondary in occurrence to the infection. We feel that the right kidney has been the seat of a much milder infection, which was probably ascending in origin and was secondary to that of the left kidney. This, however, may have been a blood-borne infection. In view of a negative genito-urinary history and urinalyses on his two previous admissions and the absence of symptoms suggesting renal infection prior to October 11th, which was the date of onset of his pyelonephritis, we feel that our assumption as to the sequence of development in this condition is probably correct, at least it seems to be the most logical explanation of the process. There is the possibility that he may have a tuberculous infection of the left kidney with fibrocaseation and occlusion of the ureter. However, I doubt this very much, and feel that it is due to the staphylococcus. We feel that a nephrectomy on the left side should be done, but should be postponed until he is in better condition, as he has been steadily improving for the past several weeks.

The condition in the right hip we attribute to the general infection which he has suffered, and feel that it is due to the staphylococcus, even though he has not shown any external evidence of suppuration in or about the hip. We occasionally see this type of destruction in bones (particularly in the young), usually in the soft cancellous or cartilaginous ends. With articular invasion a complete disintegration of a joint may ensue without suppuration where the organism is not very virulent or has become attenuated, or when the individual is recovering from a long-standing infection. This may explain the insidious process in this patient's hip.

Case IV is interesting because of the type of infection. I have not seen another case where the infecting organism was the Bacillus mucosus capsulatus. Under ordinary circumstances it is a rather benign organism, and confines its mischief to the pulmonary tissues and serous membranes, and is less virulent than the pneumococcus. Its behavior in this case was not that of the usual group of organisms producing suppuration in bone. The local symptoms (pain and tenderness) were not as marked as is usually the case in other pyogenic invasions of the same extent. Furthermore, the purulent effusion in the knee-joint did not recur after a single simple aspiration. The joint cavity was not irrigated and no germicidal agent was injected at the time of aspiration. He is also interesting because there was no sequestration, and because of the comparatively short time that was necessary to effect sterilization which was followed by prompt and complete healing of the wound.

In considering the etiology of this infection it is quite probable that his illness during September and the early part of October, which was diagnosed as influenza, was due to the Friedländer bacillus, and the osteomyelitis and knee-joint infections, which showed a pure culture of this organism, were complications of the original infection.

In a considerable percentage of acute suppurative bone infections the seat of the lesion is determined by trauma, but in a greater percentage of these cases we have no outside factor, such as injury, to which we can ascribe the locus minoris resistentiæ of the affected part. In such cases the tissue involved depends upon the invasive power and the elective localization of the particular organisms after infection of the blood-stream has taken place. This is also true of joint infections.

Some time ago we operated upon a young college student for a series of suppurative joint infections, obtaining in pure culture from each joint the streptococcus. The joints invaded in succession were the left sternoclavicular, left wrist, right hip, right metacarpophalangeal of index-finger, left shoulder, and right knee. He finally succumbed to the infection after a two and a half months' illness. At the time of death he showed signs of a pneumonia of the right lung with a fluctuating swelling in the left knee-joint. This case is referred to as illustrating again the marked affinity that bacteria may show for certain tissue.

We believe that in most cases of acute hematogenous osteomyelitis, where the lesion has not been determined by injury, the infecting organism has a special affinity for osseous tissue. This applies in particular to infections where there is multiple involvement, as was seen in Case V.

Early operation is imperative in these infections if the extensive loss of bone is to be prevented. Our usual operative procedure in infections of the long bones is to make a gutter through the cortex for the entire length of the infected area sufficiently wide to insure adequate drainage and to allow for the placement of a number of Carrel tubes, through which the entire infected surface may be thoroughly irrigated with Dakin's solution. The principles of drainage in these infections does not differ in essentials from the general principles applying to the drainage of acute purulent collections elsewhere. In the drainage of a large abscess one would be contradicting the ordinary principles of surgery in draining through a buttonhole opening. The indications in such a condition would be for an incision sufficient to permit of free evacuation. This applies just as forcibly to the drainage of acute bone abscess. Acute suppurative osteomyelitis is more of a surgical emergency than is the average intra-abdominal infection. Drainage should be secured as soon as the diagnosis is made, and in many cases this is too late, because failure in diagnosis is the error most commonly seen in the management of these cases.

Operation is done with as little injury as is possible to the medullary substance because of its important rôle in the regeneration of bone. We are not in accord with the view maintained by those who feel that trepanation is all that is necessary in these cases. Neither do we feel, as some advocate, that more extensive removal of the shaft than indicated above is called for. It is expected, where late operation has been done, that considerable sequestration will take place, but here nature will determine more accurately the loss of bone than can the surgeon. It is the damage to the nutrient artery, either from compression, from unevacuated pus in the medulla, or thrombosis of this vessel, which gages the amount of bone to be lost. We feel that trepanation in the virulent cases is not sufficient to obviate this danger, if it has not already occurred, in that it does not give adequate drainage and the intermedullary pressure is not at once entirely relieved. Furthermore, the Carrel-Dakin treatment, which is of the utmost importance, cannot be properly carried out. If extensive sequestration takes place, as illustrated in Case III, enucleation of the sequestrum is necessary, but where smaller sequestræ form in children it may not always be necessary to remove them where the cavity of the involucrum can be sterilized. Under such conditions the sequestrum is absorbed just as a graft would be. This has happened in a case upon which I have operated. Briefly, the management may be indicated in early diagnosis, early operation with adequate drainage, and Carrel-Dakin sterilization.

CLINIC OF DR. BENJAMIN LIPSHUTZ

From the Surgical Service of the Jefferson Hospital, Service of Doctor J. Chalmers DaCosta

ANATOMIC VARIATIONS AND SURGERY

The surgery of today necessitates a wide knowledge of anatomy and embryology. A prominent surgeon recently recommended a study and basic understanding of embryology "as one of the fundamental stones of surgical training." Gross anatomy even today is not without its problems, many of them of vital and practical importance.

W. J. Mayo, in discussing the relation of anatomy to present-day surgery says, always, when I have faced a new problem in this field, I have gone back to embryology, anatomy, and physiology in order to gain an idea of the meaning of these pathologic deviations which we are called upon to treat.

Variations in the anatomy of the human body are not uncommon. Many variations in anatomy occur with a sufficient degree of frequency to justify the establishment of definite anatomic types. As J. Parsons Schaeffer has put the problem, the idea of an unvarying typic form in the gross anatomy of the human body appears more or less prevalent in the practical field. There is, of course, great need of extensive study of various regions, organs, and other structures of the body, the conclusions to be based on a large number of cadavers. This has been done for some regions, but the work must be extended to include all the important regions of the body. Such studies if based on a large amount of material and discriminating work will establish anatomic types. Roentgenology has been of great value in the determination and delineations of anatomic conformations. Many minor variations from a practical standpoint can be entirely disregarded. For example, let us consider a few variations of the colon and their surgical importance.

The normal position of the colon does not permit of any strict definition; anatomic and x-ray studies disclose considerable variations in its position, length, and mesenteric attachments. Abnormal fixation of the colon may arise as the result of an arrested development. Such abnormal fixations as are dependent on adhesions arising in gross inflammatory lesions as appendicitis are not here considered. In a few cases transposition of the large intestine has been met with in that general anomalous condition known as transposition of viscera. In a larger group, partial or complete failure in the migration rotation, and fixation of the U-shaped loop is the cause of the abnormality. This movement of the intestine during fetal life normally carries the cecum from the left side of the abdomen across the right hypochondrium, and from thence shortly after birth to the right iliac fossa. The cecum may be arrested and remain in any part of its migratory course. If migration fails, a cecum may lie on the left side of the abdomen and may even occupy the left iliac fossa. The latter types of cecum produce appendi-

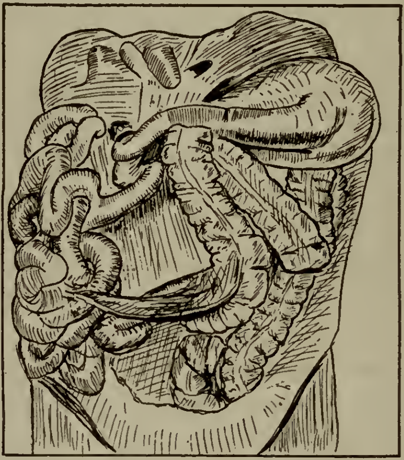

Fig. 75.—Abdominal viscera of adult human male; non-rotation of intestine. Left side appendix. (adapted from Huntington.)

citis with left-sided symptoms; cases of this type have been reported by a number of surgeons (Fig. 75).

Should rotation fail, the axis of the cecum will be altered and the ileum will enter the cecum from the right instead of, as is usual, from the left side. The cecum then lies on the left side of the abdomen and the ascending and descending colon are situated behind and to the left of the small bowel. The same relation has been observed in excessive rotation of the cecum, that is, more than 180 degrees, and all degrees of variations between these two extremes may be expected to occur according to the more or less complete failure of the changes in position which the U-shaped loop normally develops.

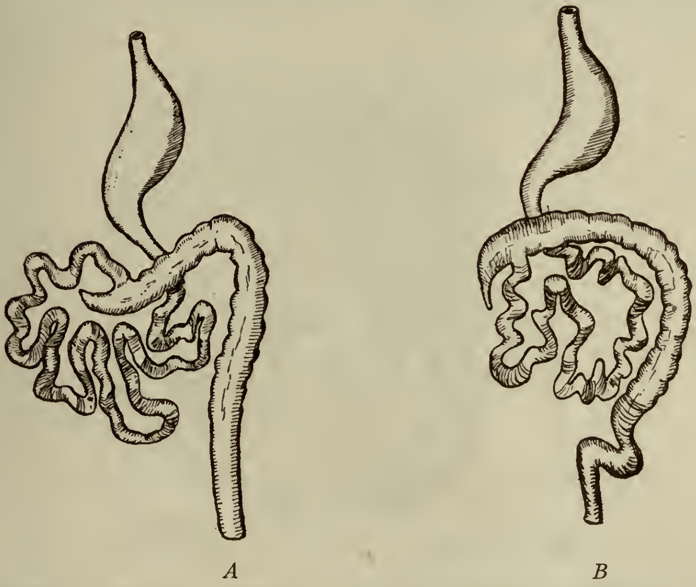

Fig. 76.—Schematic representation of final stages in rotation of cecum and large intestine: *A*, Just before final rotation of cecum and terminal ileum. Concavity of cecum directed cephalad and to the right. Terminal ileum enters colon from right to left. *B*, Rotation completed. Concavity of cecum turns caudal and to the left. Terminal ileum enters colon from left to right. (adapted from Huntington.)

The cecum may be situated high up in the abdominal cavity, the ascending colon being absent. In the majority of fetuses the cecum is situated in front of the right kidney near the gall-bladder, and there it remains until about the time of birth, when the cecum and descending colon undergo a gradual migration toward the right iliac fossa. The cecum is the last portion of the large intestine to assume its permanent position (Figs. 76, 77).

The cause of this migration is probably due to a functional elongation of the proximal part of the colon, but it occurs only in animals adapted to the upright position. The appendix during the migration may be caught behind the cecum, thus assuming a retrocolic position; it is then lodged and fixed in the ascending mesoclon.

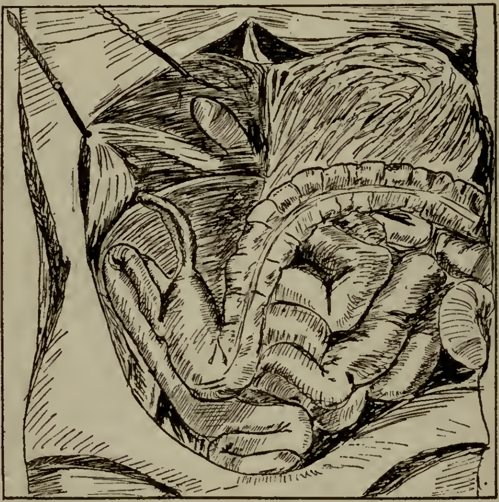

Fig. 77.—Adult subject with non-rotated cecum. Subhepatic appendix. (Adapted from Huntington.)

In a large percentage, possibly 25 per cent., of individuals the fusion between the peritoneum between the ascending or descending mesocolon is incomplete or wanting. It is well to remember that in fixation of the colon in an abnormal position, where the misplacement is due to causes other than failure in the normal development of the U-shaped loop, this abnormal fixation is always seen in the right iliac fossa. If the possibility of such abnormalities be remembered it should not be difficult to recognize the different portions of the large intestine, though in such cases the treatment must present considerable difficulties which must be met according to the conditions found in each individual case.

The peritoneal adhesions formed in the fourth and fifth month of fetal life between the transverse colon and the great omentum, and especially the adhesions which the ascending colon forms just before and after birth as the cecum assumes its position in the iliac fossa, are subject to a great range of variations and many peritoneal folds and recesses may be formed. Many of the latter variations have been variously designated in the literature as Lane's kinks, Jackson's membrane, Eastman's membrane, pericolic adhesions, etc. They have been regarded as the crystallization of the lines of force in the mesenteries formed in reaction to the downward tendency of the viscera, for their object is to give fixation of the viscera to the abdominal wall, a fixation which occurs only in orthograde primates.

It is remarkable in how few cases these peritoneal bands are completely absent when carefully sought for during operations on the right iliac fossa.

COLON SIGMOIDEUM, B. N. A. (COLON ILIOPELVENUM AND PELVENUM)

The variations of the pelvic and iliac colon have been the subject of repeated anatomic study for many years both in the fetus and in the adult. Interest was first focused on the problem in an effort to ascertain the anatomic deficiencies in cases of atresia congenita ani. In the year 1859 the French surgeon, Hugier, made the observation that the apex of the loop of the sigmoid colon in the older fetus and in the newborn usually lies in the right iliac fossa, and as a result of this observation recommended the performance of all artificial ani (anus practernaturalis) through an incision over the right iliac fossa. Whereas, other observers of the same period, particularly Giraldes, who made their studies on adult material, recommended the left iliac region as the preferable site for the artificial anus. The controversy based on these two opposite opinions continued for many years, many authorities supporting Hugier, and an equally large number of authorities stoutly defending Giraldes' opinion.

Anatomically both Hugier and Giraldes were correct, as will be illustrated below. Conclusions drawn hastily and not verified by extensive anatomic study are not of infrequent occurrence. Both of the above expressed views have elements of truth, and illustrate particularly that studies of anatomic structures should be made to include the newborn, the several ages of the childhood period, the pubertal stage, and that of the adult.

The sigmoid colon is that portion of the large intestine between the descending colon and the rectum, and is usually described as extending from the upper border of the iliac crests, at which point the colon descendens terminates, to the third sacral vertebra, where the rectum begins. This part of the colon has been variously designated colon sigmoideum (B. N. A.), flexura sigmoidea, colon iliacum (so-called in the belief that this portion of the colon lies in the iliac fossa, which frequently, however, is not the case), colon terminale, etc. Treves and Schiefferdecker divide the colon iliopelvinum into an upper and lower segment. Both noted the importance of the distal segment, which was separately named ansa sigmoidea (Schiefferdecker), ansa omega (Treves). Jonnescu chooses the name "colon pelvinum" for the lower or distal segment and "colon iliacum" for the upper or proximal segment. Testut and Jacob recommend and use the name "colon iliopelvinum" as including both segments of this part colon, stating that this part of the large intestine usually lies both in the iliac fossa and in the pelvis. The latter name seems the best designation, for it gives an accurate index of the typical position of this portion of the colon. The multiplicity of the anatomic names that have been used to designate the sigmoid colon is evidence of its anatomic variations.

Toward the end of the fetal period we find the pelvic colon attached by a long mesentery to the posterior abdominal wall, the apex of the sigmoid loop lies high in the abdominal cavity, usually to the right of the median line; less often is it found to the left of the median line. The concavity of the sigmoid loop is directed below and to the left. The tendency of the pelvic colon to present its convexity above and to the right is due to the influence of the rotation of the mesenterium commune upon the mesentery of the lower colon.

The typical course of the pelvic colon in the newborn is as follows: the pelvic colon usually begins at the level of the origin of the left external iliac artery at the medial border of the psoas major, and takes a course to the right, forming a loop the concavity of which is caudal and directed somewhat to the left. The apex of the loop is usually situated a little to the right of the median line, rarely in the median line. The right border of the loop is in contact with the cecum, and from a point to the right of the median line dips in the true pelvis (Fig. 78). A few variations from this typical position which occurs in approximately 80 per cent. of newborn are illustrated in Figs. 79–82.

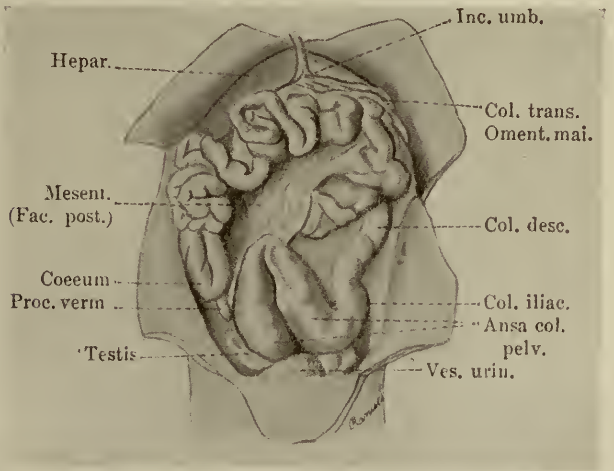

Fig. 78.—This type of sigmoid colon occurs in approximately 80 per cent. of newborn. For description refer to text. (Hermann Gysi.)

In many normal types of sigmoid colon the apex of the colon loop rests against the radix mesenterii. If the growth of the pelvic colon advances to an abnormal degree, the loop or loops

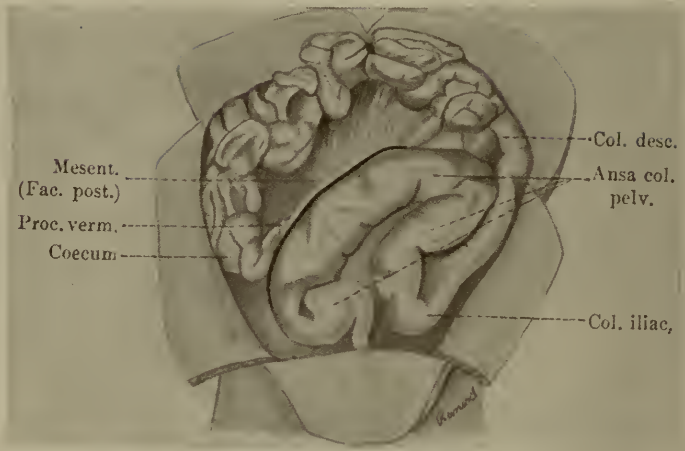

Fig. 79.—Represents apex of the sigmoid loop directed toward the left. (Hermann Gysi.)

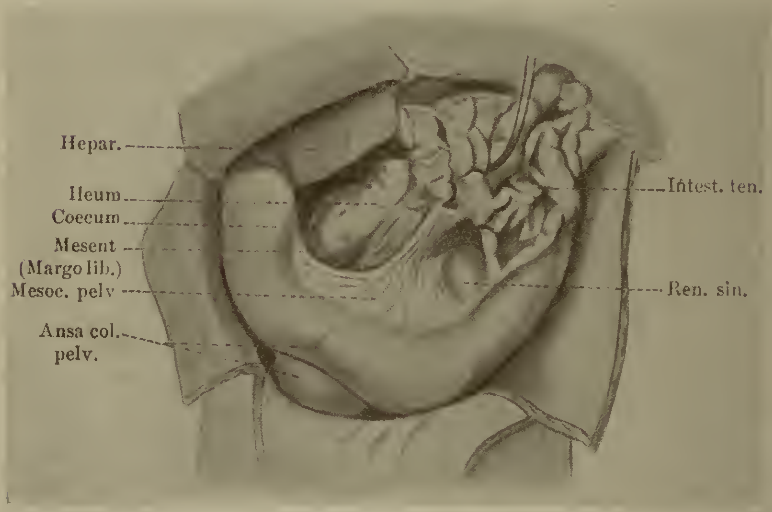

Fig. 80.—An enlarged sigmoid lying to the right of the cecum. (Hermann Gysi.)

of the sigmoid may lie in front of the cecum and appendix, and in an operative approach over the right iliac fossa the loop or loops of the sigmoid would first be encountered; merely drawing the sigmoid to the left exposess to view the cecum and appendix in these types of colons (Fig. 83).

As noted above, the narrowness of the pelvis in the newborn is the principal reason for the abdominal position of the sigmoid colon. In the adult this narrowness of the pelvis no longer is present and the sigmoid colon now sinks into the cavity of the pelvis. The course and relation of the sigmoid in the true pelvis essentially conforms to that described in all standard text-books of anatomy, and need not be presented here.

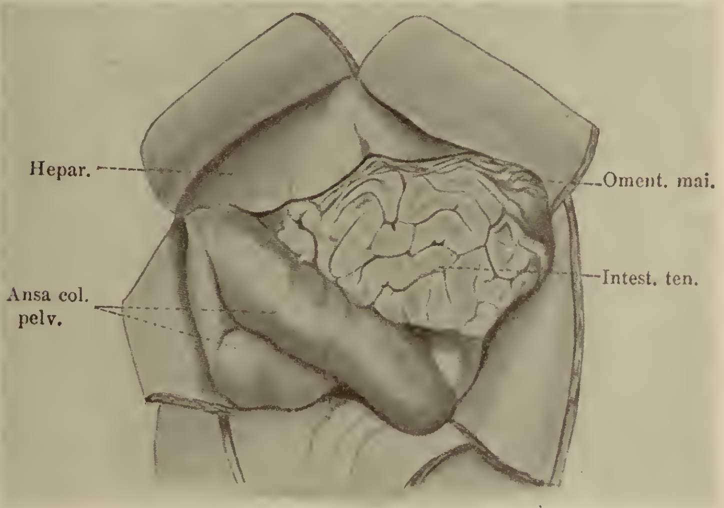

Fig. 81.—Represent an unusual variation in the position and relations of the sigmoid. (Hermann Gysi.)

The sigmoid colon even in the adult may be entirely located in the abdominal cavity and not in the pelvis, as was pointed out by Jonnescu. The abdominal position of the sigmoid colon is the result of one or two factors: (1) An unusual extraordinary increase in size (physiologic or pathologic) of the other viscera of the pelvis (bladder, uterus, ampulli recti); (2) extraordinary enlargement of the sigmoid colon.

In the first group the relations are similar to those observed in the newborn. As noted in the description of the sigmoid colon of the newborn, the pelvic colon rests against the posterior abdominal wall and the apex of the loop usually lies to the right of the median line.

The sigmoid is the most variable portion of the colon. The proximal or iliac portion usually lies in the iliac fossa, the distal or pelvic, in the true pelvis. The ascending or proximal iliac loop usually takes a vertical or slightly curved cephalically directed course, and is not infrequently fixed to the parietal peritoneum of the posterior abdominal wall by a peritoneal band or fold which fixes the iliac colon in a position parallel and to the right of the colon descendens. The mesentery of

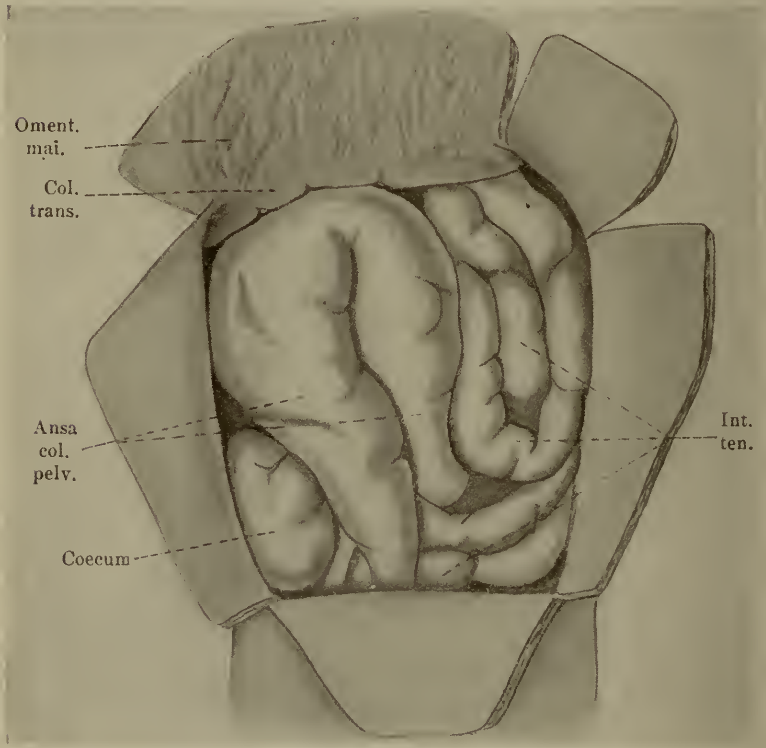

Fig. 82.—An unsually redundant sigmoid, filling one-half of the abdominal cavity. (Hermann Gysi.)

the sigmoid colon in the latter types of colon is attached only to the distal loop. In a number of the cadavers examined the mesentery of the entire sigmoid colon was so short that the entire sigmoid colon was practically fixed. In the latter types of sigmoid colon the distal loop is at times very small, the proximal loop immediately joining the rectum.

The particular surgical importance of the latter types of sigmoid colons is the impossibility of delivering the sigmoid colon into an operative incision without initial mobilization through an incision of the parietal peritoneum. Fixation of the sigmoid colon occurs in 5 to 8 per cent. of all colons, and accounts for the occasional difficulty encountered by the surgeon in the attempt to deliver the sigmoid colon for immobilization as the initial step in the performance of a colostomy or other surgical procedures on the sigmoid.

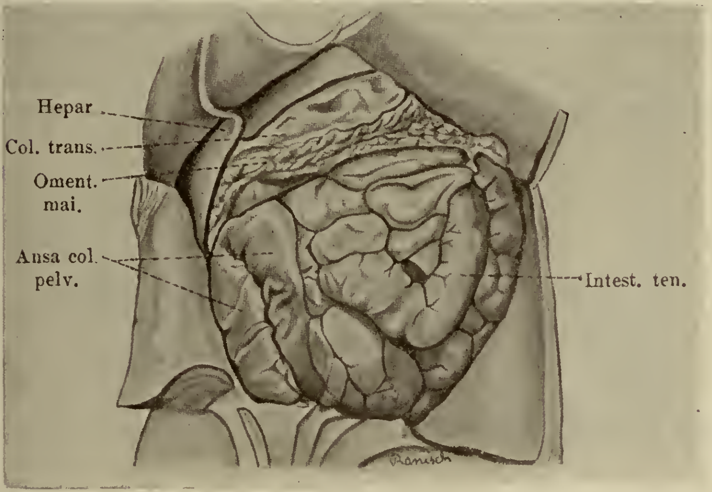

Fig. 83.—Large sigmoid occupying the right side of the abdomen and obscuring from view cecum and appendix. (Hermann Gysi.)

In the typical position of the sigmoid colon the cephalic limit of the loop does not extend above the umbilicus. A persistence of a number of fetal positions, as illustrated above, may be present in the adult, and can account for an abnormally high situation of the sigmoid colon. The apex of the sigmoid loop may have a position above the umbilicus and lie against the liver, stomach, or spleen. In such cases the pelvic colon often forms one large loop, lying in front of the small intestine and directly against the anterior abdominal wall. These types of pelvic colon at times may ensnare a loop of the ilium, particularly if the pelvic loop is directed toward the right (Fig. 84).

The redundancy of the sigmoid is practically always limited to the distal or pelvic loop, and this portion of the sigmoid is the most common site of the volvulus. In extreme cases the pelvic loop of the sigmoid seems to fill the entire abdominal cavity.

Recently the writer encountered at operation an enormously and widely dilated redundant sigmoid, with a mesosigmoid whose base was about 7 cm. and its length and height 24 and 16 cm. respectively. The widely dilated sigmoid loops had sagged downward, accentuating the normal angulation at the point where the descending colon joins the iliac loop of the sigmoid, resulting in a true kink and producing symptoms of intestinal obstruction.

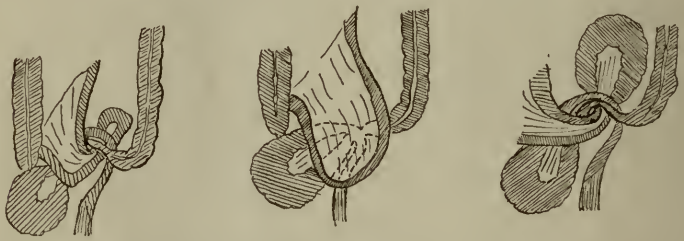

Fig. 84.—Schematic representation of redundant sigmoids ensnaring a loop of the ileum.

Redundancy of the sigmoid is usually associated with an unusually large mesosigmoid, allowing free mobility; the latter types are the ones which are likely to become the site of volvulus or abnormal angulations.

In conclusion, admittedly very many variations are insignificant and can be ignored in the practical field, despite the fact that they may be of great interest to the student of embryology and morphology. However, it is a matter of grave concern to the physician and surgeon that many important variations and anomalies must be dealt with continually. It is, therefore, clearly obvious that the adherence to a single fixed and arbitrary normal is fraught with danger; since with variations come altered size, altered shape, altered anatomic relations. Morphologic variation must necessarily have an important bearing on physical diagnosis, pathology, clinical medicine, and surgery. Indeed, the "anatomic type" always looms up before the man in the practical field as an important factor in treatment and prognosis (Schaeffer).

CLINIC OF DR. I. S. RAVDIN

UNIVERSITY HOSPITAL

LUMBAR HERNIA THROUGH GRYNFELDT AND LESSHAFT'S TRIANGLE

LUMBAR hernia was first mentioned by Barbette in the seventeenth century. Two types have been described—the high and the low. Both types are infrequent, the high being supposedly much rarer than the low. The left side is said to be more often the site than the right, and there is a divergence of opinion as to whether it is more common in the male than in the female. Although they are more apt to occur in elderly individuals, with poorly nourished and relaxed tissues, the lesion may be congenital—Budgeon reported a congenital case as early as 1728. In the discussion of true lumbar hernia we should not include those hernia which are the direct result of trauma, suppuration, or operations in the loin region. However, from the standpoint of treatment, the principles of repair may be analogous.

E. A., male, aged forty, was admitted November 5, 1922, complaining of a bulging in the left loin. He stated that two years previously he was stabbed in the left infracostal region, posteriorly, which wound was sutured and healed by primary intention. During the spring of 1922 he had a sensation of weakness in the left loin and he noticed a gradually increasing bulging in the upper loin space. This became so annoying that he sought relief at a hospital, where he was told that he had a lumbar hernia, and was advised to be operated on. An operation was performed in July, 1922. In September the sensation of weakness in his side returned, and soon after this he again noticed a bulging in the region of the scar.

Physical Examination.—The patient is a white, fairly well-developed male of somewhat flabby musculature. The only abnormal findings are in the left loin space, just below the twelfth rib, and to the outer side of the erector spinæ muscle is a scar, about 1½ inches long, the site of the stab-wound. Below this is a long oblique scar (Bergman incision). This scar forms the summit of a bulging mass which is about the size of an orange. When the patient is recumbent the bulging disappears, and when he resumes an upright posture it gradually reappears. When pressure is made over the area and the patient coughs an impulse is felt.

A diagnosis of recurrent lumbar hernia through the fascial triangle was made.

A knowledge of the anatomy of the muscles and fascia, which make up the posterior abdominal wall between the last rib and the iliac crest, is of the utmost importance in order to clearly understand the surgical relations in lumbar herniæ. The space varies according to the length of the twelfth rib and according to the type of chest, with its effect upon the position of the ribs. Thus, in the slender individual with acutely sloping ribs the space is decreased, while in the emphysematous type the space is increased. The tip of the twelfth rib in the average person lies about 2 inches vertically above the center of the iliac crest.

The costo-iliac space is limited medially by the lateral edge of the sacrospinalis, laterally by the posterior border of the external oblique, while the entire space is covered posteriorly by the tendon of origin and muscle-fibers of the latissimus dorsi, except in its lower part, where a narrow triangle is left between the lateral border of the latissimus dorsi and the posterior fibers of the external oblique.

This triangle, known as Petit's triangle, is a space of variable size. Below, it is bound by the upper margin of the posterior portion of the iliac crest. Laterally is the posterior edge of the external abdominal oblique muscle, and medially it is bounded by the lateral edge of the latissimus dorsi muscle. The floor is formed by the lower posterior fibers of the internal oblique, while in front of these lies the tendon of origin of the transverse abdominal and quadratus lumborum muscles (Fig. 85).

In a well-musculated individual the latissimus dorsi and the external oblique may overlap, obliterating the triangle. Goodman and Speese, in 76 dissections, found the triangle missing 12 times on both sides, and 4 times on one side only. In the anatomic laboratory a great variation in the size of the base of the triangle is seen. The triangle also differs from the upper triangle in that neither nerves nor vessels pierce its floor.

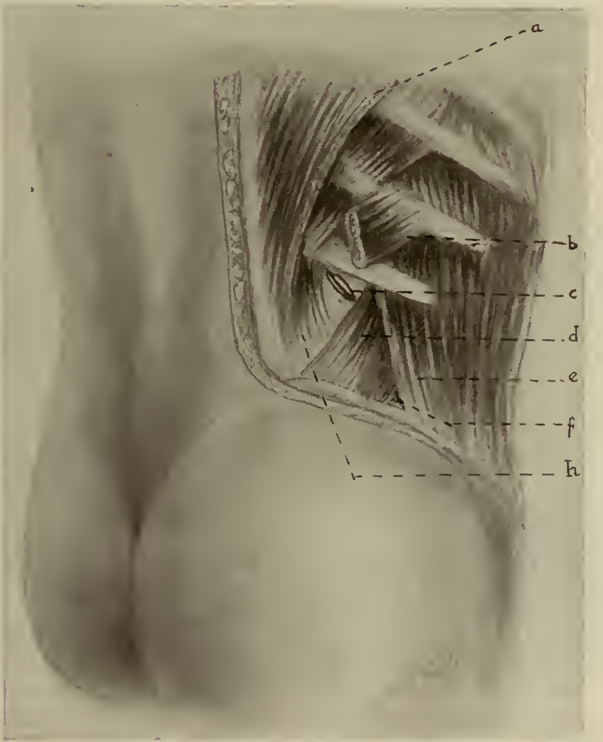

Fig. 85.—*a*, Cut edge of latissimus dorsi; *b*, serratus posterior inferior; *c*, fascial triangle, showing location of sac; *d*, internal oblique; *e*, external oblique; *f*, site of Petit's triangle; *h*, quadratus lumborum.

After removing the latissimus dorsi and removing or retracting the lower digitation of the serratus posterior inferior, the upper larger triangle is exposed. This is the second weak point of the loin, and is known as the fascial or Grynfeldt and Lesshaft's triangle. It is more constant than the lower or Petit's triangle. The shape and size of both vary. It is bounded above by the lower edge of the twelfth rib, medially by the sacrospinalis and quadratus lumborum, and laterally by the posterior fibers of the internal oblique. The floor is fascial, being the site of the fusing of the lumbodorsal fascia, which, anteriorly, forms the aponeurosis of the transversus abdominis and posteriorly splints into three layers to enclose the sacrospinalis and quadratus lumborum (Fig. 86). While the middle and posterior layers are dense, the anterior is very thin, and is continuous with the transversalis fascia. There is no muscle to buttress the floor in this upper triangle, except occasionally the thin outer third of the quadratus lumborum, which may lie external to the sacrospinalis. The space is further weakened by the twelfth intercostal nerve and vessels piercing the fascia. Grynfeldt in 1860, in describing this space, said, "The aponeurotic fibers of the

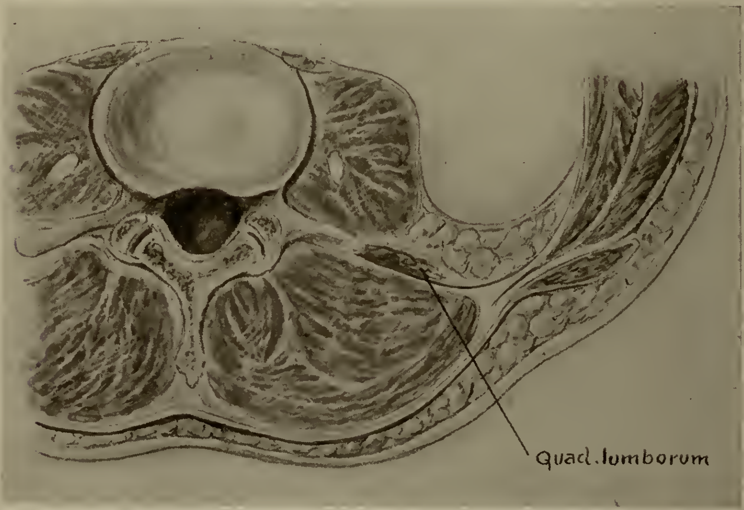

Fig. 86.—The anatomic relations in *a* cross-section through the fascial triangle.

transversalis in dividing form a space for the lower intercostal artery, just as the sperm cord enters the two pillars of the external ring."

Operation.—I. S. R. Ether anesthesia. The patient was put on his right side and a kidney pillow placed under the right loin. An oblique incision was used, excising the previous scar. The peritoneal sac was found beneath the latissimus dorsi aponeurosis and dissection was continued until its base was exposed. The outer and inner muscular fibers of the latissimus dorsi, quadratus lumborum, and internal oblique were exposed and freed so that they could be overlapped without tension. The lumbodorsal fascia was likewise freed. The left thigh, which had previously been prepared, was exposed and through an H-shaped incision a piece of the fascia lata, about 6 inches square, was removed and placed in warm normal salt solution. The kidney pillow was removed.

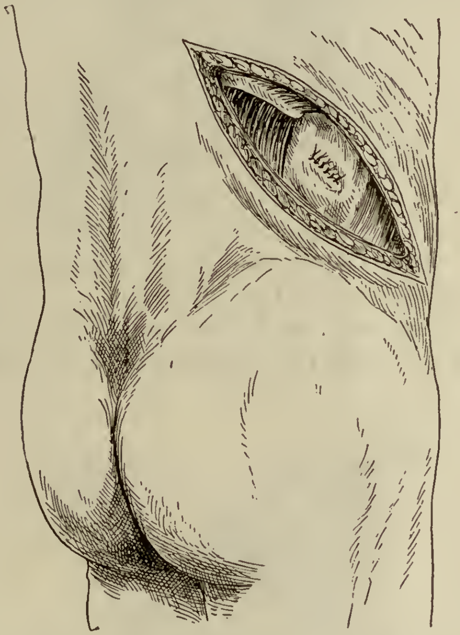

Fig. 87.—Sac inverted and oversewed. Anterior layer of lumbodorsal fascia exposed.

The peritoneal sac was then inverted and oversewed with chromic catgut (Fig. 87). The aponeurosis of the transversalis was then brought together and reinforced with a piece of the fascia lata, which was attached above to the periosteum of the twelfth rib, medially to the under surface of the quadratus lumborum, and laterally to the transversus abdominis and internal oblique (Fig. 88). The internal oblique and quadratus were brought together without undue tension with interrupted sutures

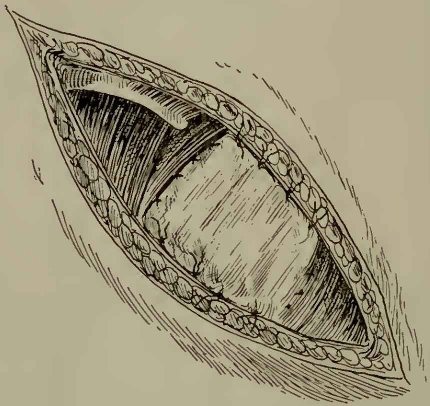

Fig. 88.—First piece of fascia lata in place.

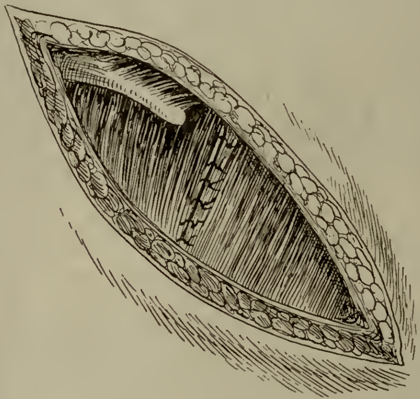

Fig. 89.—Internal oblique and quadratus lumborum sutured.

(Fig. 89). The latissimus dorsi was then closed (Fig. 90) and the remaining piece of the fascia lata was sutured over this and attached anteriorly to the posterior fibers of the external oblique (Fig. 91). The skin was closed with interrupted sutures of silkworm-gut.

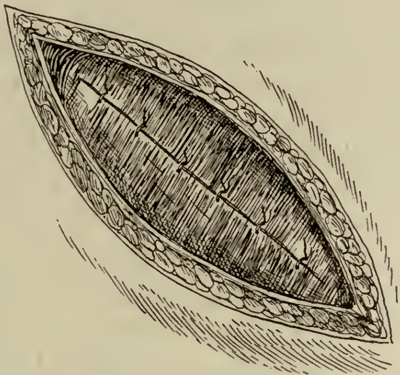

Fig. 90.—Latissimus dorsi closed.

The patient made an uneventful recovery, being allowed out of bed in three weeks. When seen on January 15, 1923 there was no evidence of weakness of the posterior abdominal wall. There was, however, a small collection of serum in the thigh

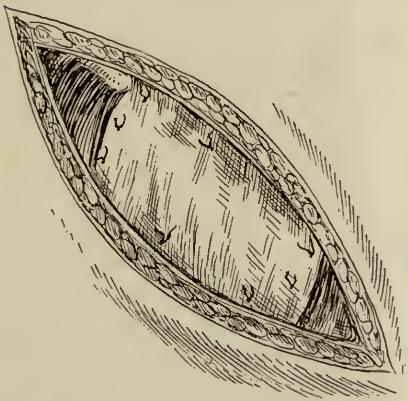

Fig. 91.—Last piece of fascia lata in place.

where the fascial graft had been removed. I do not know why this had not been absorbed after so long a time.

It may be said that this was not a true lumbar hernia, since the stab-wound may have contributed to the weakness of the abdominal wall. The operation described, however, is suitable for the repair of a hernia in this region, regardless to the etiology, since it is based on the anatomic relations of the region. Even if a hernia occurred following suppurative processes with extensive scar tissue supplanting in part the muscular tissue, I believe that the fascial transplant offers the best chance of permanent cure.

The question has been raised as to whether or not a sac is present. In this case the sac was well developed and was similar to the sac found in the umbilical hernia. I do not know what the sac contained, since I did not open it, but it might contain omentum, large or small gut, or possibly, the kidney. Cases have been reported that have been strangulated, but this is not the rule, since they are usually easily reducible.

Although the text-books on anatomy and surgery place more emphasis on Petit's triangle as the site of lumbar hernia, I believe a careful investigation would show that hernia through the space of Grynfeldt and Lesshaft is much more frequent.

RUPTURED GRAAFIAN FOLLICLE SIMULATING APPENDICITIS

Acute pain in the right iliac fossa is suggestive of acute appendicitis. When to this pain is added vomiting, a slight rise of temperature, a rapid pulse, rigidity of the right rectus, and a leukocytosis, the picture of acute appendicitis seems fairly complete. The following case illustrates the difficulty of differential diagnosis:

M. S., aged fourteen years, was admitted to the hospital at 5 p. m. 1/29/22. I had seen the patient about 3 o'clock in consultation with Dr. Leebron. On the morning of the day of admission she developed severe colicky pain in the right lower abdomen. She had a similar attack a year previously, from which she recovered. During each menstrual period right-sided abdominal pain was present, but to a much less degree. She was nauseated, but did not vomit until after admission to the hospital. Her bowels were regular, and she had had a movement in the morning.

Her previous history was negative. The last period was completed four days before admission. The menses were regular and lasted from two to three days. The flow was normal, but rather painful. The menstrual cycle began six months ago.

The physical examination was negative except for the abdominal findings. There was little, if any, distention. The tenderness was limited to the right lower abdomen, being most exquisite in the region of McBurney's point. The entire right side was rigid. No masses were palpable. Rectal examination was so painful that a thorough examination was impossible. Peristalsis was exaggerated.

The blood-count was:

Red blood-cells,	4,100,000
White blood-cells,	16,400
Hb.,	69 per cent.

Polymorphonuclears,	75	per cent.
Small lymphocytes,	22	"
Transitionals,	2	"
Eosinophils,	1	"

Urinalysis was negative for sugar, albumin, casts, leukocytes, or erythrocytes.

Temperature was 99.3° F.; pulse, 114; respiration, 24.

I made a diagnosis of acute appendicitis, and decided upon immediate operation.

Operation.—I. S. R. Ether anesthesia. McBurney incision. Before the peritoneum was opened the blue-black color of the blood showed clearly through it, and the intern, who was assisting, mentioned the possibility of a ruptured graafian follicle. The peritoneum was opened and free blood escaped. The appendix, which immediately presented, was found to be normal. The incision was lengthened, the fibers of the internal oblique were cut across at right angles to the direction of the wound, and the peritoneal opening enlarged. This gave an excellent exposure of the right tube and ovary, which were delivered. A perforated follicle on the posterior surface of the right ovary was found, from the interior of which active bleeding was taking place (Fig. 92). The cavity was about 1½ inches in diameter, and the perforation was about ½ inch in length. The cyst and a portion of the ovary were removed and the remainder of the ovarian tissue ligated.

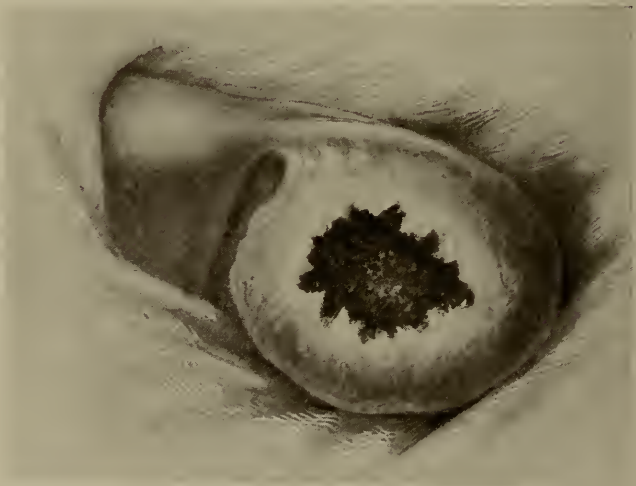

Fig. 92.—Ovary, showing approximate size of the perforation.

In all about 500 c.c. of blood were found in the peritoneal cavity. As much of the blood and as many clots were removed as possible. The peritoneum was closed as usual, the internal oblique repaired, and the remainder of the incision was closed with interrupted catgut sutures. Michel clips were used for the skin.

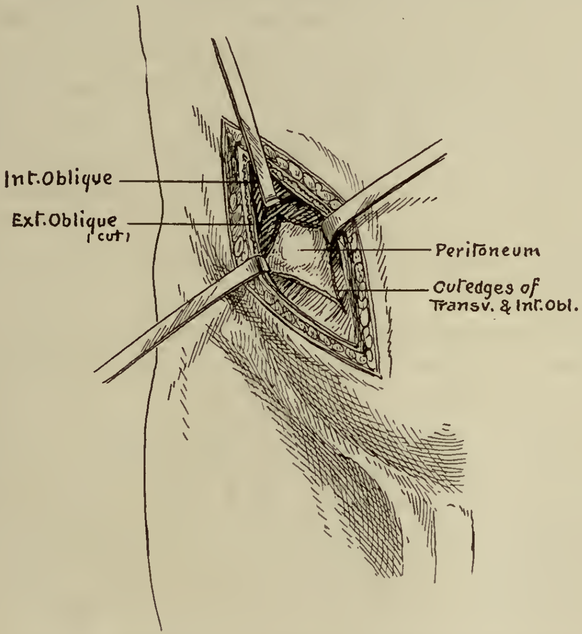

Fig. 93.—The transversalis and internal oblique have been cut at a right angle to the direction of their fibers.

The pathologic report was: "Graafian follicle perforated. Passive congestion of the ovary with interstitial hemorrhage; slight fibrosis."

The patient had an uneventful convalescence and was discharged February 13th, completely recovered.

Both Dr. Muller and myself have found the modification of the McBurney incision, as shown in the accompanying illustration (Fig. 93), very useful when greater exposure was necessary because of a low-lying appendix, or pelvic lesion. None of these patients have developed incisional herniæ. It is important to bear this in mind, since it obviates the necessity of closing the incision, and making a right rectus incision.

Nelaton, as early as 1851, was aware of the possibility of hemorrhage from a ruptured graafian follicle. Novack reviewed the literature up to 1917, and found 40 cases which he was willing to classify as ovarian hemorrhage, except that from ovarian pregnancies, and ruptured large ovarian cysts and solid tumors; 36 of the cases had been collected previously by Von Beust in 1914. Since Novack's contribution Neer, Smith, and Penn have added cases. Recently several other reports have appeared in the literature, including reports such as that of Schuman, where the tentative diagnosis was made and the patient treated expectantly.

Clinically, ovarian hemorrhage may be divided into the following groups:

1. That due to rupture of a graafian follicle or corpus luteum.
2. That occurring from perforation of a hematoma of the stroma of the ovary.
3. That occurring from atretic follicular cysts.
4. That occurring from ruptured ovarian cysts or solid tumors.
5. That occurring as the result of ovarian pregnancy.

The rupture of a graafian follicle or corpus luteum, with extensive hemorrhage, may occur just before, during, or just after menstruation. No cases have been reported as occurring previous to menstrual life or after its cessation.

The tunica interna, in the maturing graafian follicle, contains an extensive plexus of minute blood-vessels from the tunica externa, which are continued into the membrana granulosa. After the rupture of the follicle, with the discharge of the ovum, the formation of the corpus luteum begins. In the earliest stage of the formation of the luteum cells, which are probably hypertrophied epithelial cells of the membrana granulosa, there occurs the so-called period of hyperemia. During this period thin-walled, bud-like projections of the vascular plexus are found in the corpus luteum. The membrana granulosa vessels become smaller when the corpus luteum is completed, but the vessels in the tunica interna and the externa remain prominent until the period of regression of the corpus luteum is nearly completed.

It is, as yet, a moot point whether the hemorrhage is more frequent from the atretic or from the graafian follicles. During the formation of the atretic follicle the tunica interna gives rise to lutein cells of connective-tissue origin which are highly vascularized. Hemorrhage from these may occur at any period in the menstrual cycle, but it is more likely to occur at the time of menstruation with its accompanying pelvic hyperemia.

The accident occurs usually in young women. In the young virgin it is most frequently diagnosed as acute appendicitis, as in the preceding case, while in the married woman it may be confused with either appendicitis or ectopic pregnancy.

The amount of bleeding varies from the amount which normally occurs with each ovulation to massive hemorrhage causing early exodus. Schuman has reported 3 cases in young girls who displayed all the phenomena of intraperitoneal hemorrhage, but were treated expectantly and recovered. In the cases of massive hemorrhage pallor, and air-hunger, together with an anemia, and a pelvic mass, may aid in the differential diagnosis.

Should the possibility of ovarian hemorrhage be kept in mind, a positive diagnosis might be made before operation. However, I feel that should the diagnosis be made, it would be better to operate, regardless of the severity of the symptoms present, because certainty of diagnosis cannot be assured without laparotomy, or the possibilities of continued bleeding be calculated.

NEUROSURGICAL CLINIC OF DR. CHARLES H. FRAZIER

University Hospital

UNILATERAL EXOPHTHALMOS: A CLINICAL REPORT OF FIVE CASES

(Reported by Dr. Karl Musser Houser)

The occurrence of unilateral exophthalmos is by no means rare. Regardless of its frequency as a symptom, individuals presenting this finding are always worthy of intensive and thorough study on account of the variety of factors which may be concerned in the etiology and the difficulty which is sometimes encountered in arriving at a definite diagnosis. Through the courtesy of Dr. Charles H. Frazier the following cases, having in common this one symptom—*i. e.*, unilateral exophthalmos—which were recently studied by the neurosurgical service at the University Hospital, are here presented.

Illustrative of the fact that the diagnosis of this condition is not always obvious and is frequently difficult, we may consider the case of an adult male, aged forty years, who was admitted to the neurosurgical service complaining of headache and nausea. Three years before he had developed gradual loss of vision of the right eye. On admission this eye was totally blind. In March, 1922 he had his initial attack of pain and vomiting. This pain was located in the frontal region, was dull, constant, neuritic in type, and persisted for about seven days. He was then free from subjective symptoms, excluding his unilateral blindness, until nine months later, when his subjective symptoms returned. From that time until admission in January, 1923, more or less pain had been constantly present and vomiting was a frequent occurrence. Two days before coming to the hospital ptosis of the right eyelid developed.

With the exception of the findings associated with the right eye, physical examination was entirely negative. An examination by Dr. DeSchweinitz revealed ptosis of the right lid, absence of light perception, an inactive iris, and a slight degree of exophthalmos, 4 mm. in advance of the opposite side. Complete atrophy of the optic nerve had taken place; upward and outward motion was markedly limited. The left eye retained normal vision, fundus, fields, and motion.

The spinal fluid pressure was found to be slightly elevated, 22 mm. of mercury. A cell count showed 10 cells per cubic millimeter. All other laboratory studies were negative.

Taking into consideration the increase of spinal fluid tension, it was thought that quite likely an intracranial lesion was responsible for the condition. *x*-Rays taken elsewhere indicated some slight thickening of the tissues about the apex of the orbit. An orbital tumor was considered another possibility. It was decided to explore the orbit, withholding more radical intracranial procedures until orbital growth could be certainly ruled out. This was done by Dr. Frazier, using the Krönlein method of approach. The outer and upper walls, the boundaries under suspicion, were thoroughly inspected. No tumor was found. The patient is convalescing nicely from this procedure and to date has had entire relief from both pain and vomiting. The etiology of the condition giving rise to the exophthalmos, however, is still undiscovered. No subsidence of the protrusion has occurred. Does a tumor actually exist, perhaps primary in the optic nerve, or in some other portion of the orbit which our exploration has failed to reveal? Does an intracranial lesion exist which has given rise to this unilateral symptom? These questions can be answered only by further study, investigation, and perhaps operation.

That the conclusive diagnosis of orbital abscess is not always a simple matter is illustrated by the case of a middle-aged Jewish female who came to the hospital early in December, 1922, complaining of pain and protrusion of the right eye. The pain had persisted for eight weeks. It was sharp, throbbing, and continuous, most marked in the orbit and supra-orbital regions.

No loss of visual acuity was associated, no febrile phenomena nor leukocytosis. Her right eye was decidedly exophthalmic, the supra-orbital margin puffy, the skin of this region as well as that of the right lid boggy with edema. Downward and inward deviation of the globe was present. There was paresis of all the extra-ocular muscles. Blood and spinal fluid were negative. x-Ray pictures showed some clouding of the right ethmoid air-cells.

Exploration of these spaces was decided upon, and was performed by Dr. David Husick. A considerable quantity of pus was found and evacuated. In a few days she was discharged relieved of pain. Five weeks later she returned, her exophthalmos much more marked than on discharge. Pain was not a prominent symptom, but on account of a sensation of abnormal fulness in the right eye she was very uncomfortable. A mass could be easily seen and palpated beneath the supra-orbital ridge in the upper and outer orbital quadrant. Although the existence of an orbital abscess was suspected, the absence of fever, leukocytosis, and the general symptoms of infection made this supposition rather questionable. It was thought that there possibly existed a neoplasm of the orbit which had been developing prior to the sinus infection and which at about the same time began to manifest itself. Regardless of the nature of the lesion exploration was indicated. Dr. Frazier performed this operation, approaching the orbit from beneath the supra-orbital ridge. A large subperiosteal abscess, communicating with neither the tissues of the orbit nor with any of the adjacent air spaces, was found, evacuated, and closed with a Dakin tube *in situ*. The patient made an uneventful recovery.

Illustrative of the gravity with which unilateral exophthalmos may be attended, let us consider the case of a forty-year-old female who was admitted with a chief complaint of headache, fever, chills, and protrusion of the left eye. Four weeks before she had had a slight attack of laryngitis from which she apparently entirely recovered. About a week later she began to have headaches, occipital at first, later generalized. These headaches were extremely intense, constant, and throbbing.

Although not a neurotic individual, she frequently screamed with pain. Two days before admission she had elevation of temperature for the first time. Twice she had been shaken by severe chills associated with an axillary temperature of 107° F. Twenty-four hours before coming to the hospital marked swelling and protrusion of the left eye had occurred. Upon admission she was mentally clear, temperature by axilla 105° F., leukocytes 23,000. The left eye showed marked proptosis, a chemotic conjunctiva, complete ophthalmoplegia, and was exquisitely tender. The fundus was negative except for haziness of the upper disk margin. Slight redness and edema of the lids was the only abnormal finding in the right eye. The angles of both jaws were tender to pressure and the mouth could be opened to but half the normal limit. Both sides of the face were slightly swollen. *x*-Ray examination by Dr. Pancoast was negative except for slight clouding of the left maxillary sinus. A diagnosis of cavernous sinus thrombosis was made.

In the hope that this diagnosis was incorrect, exploration of the left antrum of Highmore and the left ethmoid air-cells was made. No pus was found nor was the condition of the patient relieved. It was then considered best to explore the orbit in the hope of finding an abscess and establishing drainage. This was done by Dr. Frazier, with negative results. At the same time intracranial exploration was performed by an approach superior to the left frontal sinus. The cerebral cavity was examined extradurally as far posteriorly as the cribiform plate. No evidence of abscess was present, symptoms were not relieved. Blood-cultures taken on two occasions showed no growth. Her mentality was undisturbed. She continued to show wide temperature fluctuations—100 to 107 degrees—the exacerbations being accompanied by severe rigors. The left eye became more and more prominent and showed slight bluish discoloration. The appearance of the right eye began to approximate that of the left on admission. Her skin assumed an icteroid hue, she became more and more toxic, excessive diarrhea developed, and death occurred seven days after admission and four following operation. Autopsy was refused.

Here is a case of exophthalmos obviously infective in origin, the infection being extremely virulent and malignant in nature. Although at all times the diagnosis of that "most dramatic and tragic of orbital infection"—*i. e.*, cavernous sinus thrombosis—was considered practically certain, operative interference was instituted in the hope that the diagnosis was faulty and that possibly something could be done. The source of the infection is uncertain. Was the slight laryngitis preceding the onset of symptoms in any way associated? Did a cerebral abscess exist which by contiguity involved the blood-space affected? These are questions upon which, in the absence of postmortem findings, one can only speculate.

Another condition which can give rise to this one-sided physical finding is demonstrated by a thirty-six-year-old female who came to us on account of pain in and above the left eye. This pain had been intermittently present for the preceding six years, was paroxysmal in type, quite severe, and at first readily relieved by aspirin. Changes in the weather, excitement, and anxiety seemed to institute or aggravate the pain.

On admission she complained of constant pain. This pain was located in the eye itself, along the left side of the nose, and in the left temple. Occasionally she had attacks of vomiting. This she attributed to medicines taken. Examination showed ptosis of the left upper lid, almost complete paralysis of the extra-ocular muscles, moderate exophthalmos, normal pupillary reactions, with no abnormal fundus or visual field findings. She was seen by Dr. Spiller and Dr. Dercum in consultation with Dr. Frazier, who agreed that there was evidence of involvement of the left third, fourth, fifth, sixth, seventh, eighth, ninth, and tenth cranial nerves. A lesion, neoplastic or inflammatory, located at the base, flat and plaque-like in type, involving the nerves mentioned at the points of emergence from the skull was thought to be the most plausible explanation. The family would consent to no operative interference. A rigid rest cure, indicated by the patient's undoubted neurotic tendencies, was instituted and carried out with slight, if any, improvement. Upon request of her family she was discharged one month after admission.

Here you may rightly say that in the presence of so many other and more significant symptoms and findings the importance of the proptosis was practically negligible. Its presence, however, merely serves to illustrate another condition with which it may be present—*i. e.*, paralysis of the musculature of the orbit.

There is a special group of cases of which a considerable number have been reported in the literature which can readily be explained upon physical grounds. A seven-year-old boy admitted to the service of Dr. deSchweinitz and later transferred to the neurosurgical service for operation serves to illustrate this interesting condition. Briefly, his history is as follows:

Two years before coming to this hospital he experienced a fall of six feet, at which time he fractured his right clavicle and received a blow upon the head. Six weeks later his father, a physician, noticed distention of the left angular vein. A distinct thrill was palpable over this area. This distention progressed and was associated with a definite, advancing, pulsating exophthalmos. Ligation of the left common carotid artery was performed at the Mayo Clinic in July, 1921. Slight improvement of the exophthalmos followed. Three months later resection of the dilated angular veins was performed, subsequent to which the exophthalmos became more pronounced and dilatation of the conjunctival veins occurred.

Examination on admission revealed a healthy normal boy with no evidence of constitutional disease. The left eye showed pronounced exophthalmos associated with moderate pulsation. The veins of the palpebral and bulbar conjunctivæ, those of the upper and lower lids, of the temple, and left forehead were markedly distended. The entire area had a purplish tinge. A loud bruit could be heard over the left side of the head most intense in the temporal region. Subjectively he complained of whirling noises in his head. Pressure over the left jugular vein caused almost complete disappearance of the bruit; compression of the right common carotid artery had a similiar effect. Vision of the affected eye was not impaired. A diagnosis of pulsating exophthalmos the result of arteriovenous aneurysm of the internal carotid artery and the cavernous sinus was made, and operation advised. An operation was performed by Dr. Frazier, which consisted of a gradual obliteration of the lumen of the right internal carotid artery, first by arterial clamp, ten days later by ligation. The procedure was well tolerated. Two weeks later he was discharged with no appreciably improvement in his eye protrusion, the sensation of buzzing in his head, however, having almost entirely disappeared.

It is our hope that the meager details of the cases presented will to some extent illustrate this interesting and sometimes rather complex symptom of unilateral exophthalmos. It should be within the power of the investigator to discover a physiologic, physical explanation for all cases of exophthalmos involving one or both eyes. When one alone is involved we can almost surely eliminate a systemic or general condition, such, for example, as toxic goiter. Under such conditions the failure to locate the combination of physical and physiologic conditions which is responsible for the symptom is a confession of our inadequacy.

In the study and investigation of cases presenting this unilateral condition it is necessary to bear in mind the variety of lesions which may contribute and give rise to such a situation, and by the process of elimination arrive at a correct diagnosis. We must take account of the mechancial factors. Has the orbital space been decreased by invasion of neoplastic, cystic, or inflammatory tissue? Are the orbital vessels themselves the cause of the disturbance? Can the nerves and muscles be at fault? Is there modification of refractive power due to alteration of the axes of the bulb the result of compression? What fundus changes have taken place? Has trauma occurred subsequent to which their is emphysema of the orbital tissues or alteration of the adjacent blood-vessels? What is the condition of the osseous air spaces which are such close and important neighbors to the orbit? Does constitutional disease exist, and if so, what is its relation to the condition? Is there hemorrhage, relaxation of orbital tissues, sympathetic involvement, evidence of intracranial disease, glaucoma, pulsation, inflammation, edema, or suppuration? These questions must be answered before, in a condition such as this, we can diagnose, prognosticate, or treat.

CLINIC OF DR. FRANCIS C. GRANT

From the Neurosurgical Service of the Graduate School of Medicine of University of Pennsylvania

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THE USE OF AIR IN THE DIAGNOSIS OF INTRACRANIAL LESIONS: AN ILLUSTRATIVE CASE

The use of air as a medium for determining the size and shape of the cerebral ventricles originated with Dandy. He first used it to indicate the position of the obstruction in cases of hydrocephalus. As it was found that the outline of the ventricles could be clearly demonstrated and any change in their outline or position easily seen, the diagnostic possibilities of the procedure in cases of new growth with or without an accompanying hydrocephalus were realized. In order to outline the ventricles on an *x*-ray plate a medium either more or less dense than the surrounding bone must be used. No substance more dense than the bone has been found that is not too toxic to be injected into the brain. Air shows on the *x*-ray plate as an area of decreased density. It is less dense than the cranial bones. The injection of air into the ventricles produces no toxic effect.

The present case illustrates a further use of air in the diagnosis and localization of cranial lesions. If at the operating table a deep-seated cyst is encountered, it is the part of wisdom to attempt to determine the size and location of the cyst before an effort is made to remove it. This is particularly true if the cyst is gliomatous in origin. If, on introducing an exploring cannula, a clear canary-yellow fluid is obtained, this finding is pathognomonic of a gliomatous growth which has undergone cystic degeneration. The presence of a gliomatous growth complicates the operative procedure. These tumors are infiltrative in character and commonly unencapsulated. For reasons not clearly understood patients having gliomatous tumors quite commonly show marked reaction after the simplest operative interference. Since it is almost impossible to extirpate a large glioma *en masse*, and since any such maneuver would with certainty be followed by the onset of a cerebral edema and extreme danger to the patient, whenever a large cyst, evidently gliomatous, is encountered an attempt should be made to localize its position. The surgeon can then decide whether it is possible to attack it successfully at a second operation, or whether it is wiser to leave it alone. Once its position is known it may be treated by repeated tapping and intensive radiation if removal seems out of the question.

This is precisely the problem that faced us in this case. The dura, on opening the skull, was very tense. In attempting to tap the left ventricle for the relief of this tension the exploring cannula entered a cyst and evacuated 5 c.c. of yellowish fluid. A diagnosis of a large gliomatous cyst was made. Even after we had removed about 5 c.c. of fluid from one part of the cyst and tapped the ventricle on the other side, the tenseness was but little relieved. The dura was opened for about an inch and the brain at once commenced to herniate out through the opening, an ominous sign, showing that the brain would swell and bring on a serious degree of medullary compression on little provocation. The cyst was, therefore, again tapped; rather to our surprise an even larger amount of fluid was evacuated and an equal amount of air injected. The wound was now closed without difficulty and the patient taken to the *x*-ray department. The clearness with which the position and size of the cyst may be seen is evident from the accompanying plates.

Case History.—T. S., aged forty-six years, white, laborer, admitted to the service of Dr. T. H. Weisenburg, Polyclinic Hospital, Graduate School of Medicine, University of Pennsylvania, 10/3/22.

Chief Complaint.—Headache.

History of Present Condition.—The patient has had headaches in the left frontal region for the past six months. These headaches came on with no apparent cause. Previous to admission the headaches were terrific, but recently they have been dull.

These pains were located at first in the occipital region, now they are frontal in position, particularly on the left side. There are remittances for two or three hours, after which the pain returns. There has also been some pain in the eyes. No vertigo or staggering. Projectile vomiting two or three times a day for the last six weeks. No dizziness. There has been some obscuration of vision in the left eye for the last two months. A gradual loss of strength with slight loss of weight has been noted. No paralyses or weakness present.

No palpitation, hemoptysis, or hematemesis.

Slight cough and dyspnea noted.

No urgency, frequency, or hematuria.

Past Medical History.—Fourteen years ago he had very severe headaches with almost complete loss of vision. This condition all cleared up. No other sickness.

Social History.—Laborer in the coal mines. Home conditions fair. No alcohol or tobacco.

Family History.—Mother and father dead, cause unknown. Wife and one child living and well. No miscarriages.

Physical Examination.—Well-nourished, well-developed adult white male. He lies in bed with his hands to his head, as though in considerable pain. It is almost impossible to make him understand what is said, and for this reason it is difficult to obtain any impression as to his mentality. The few English words that he can speak are fairly clear. He seems to have no difficulty in articulation and he talks intelligently in his own tongue to his wife. She says that she has noticed no deterioration in his mentality.

Hair: Coarse and thick, scalp otherwise normal. No bony prominences. Some tenderness to percussion over the left frontal region.

Teeth: Some old stumps and a marked pyorrhea. Tonsils negative.

Neck: No thyroid enlargement, postcervical enlargement, or vascular pulsation.

Thorax: Expansion free and equal, no abnormal signs to palpation, percussion, or auscultation over lungs.

Heart: No enlargement, murmur, or arhythmia noted.

Abdomen: No visible masses, no abnormalities to palpation. No inguinal, axillary, or epitrochlear adenopathy.

Cranial Nerves.—I. No apparent loss of the sense of smell, right or left.

II. Pupils horizontally oval, and react only sluggishly to light and in accommodation. Eye movements apparently normal when not being tested, but when an attempt is being made to test him he does not understand commands and fails to rotate. There is apparent deviation on attempt at near fixation, but as he sees very little except light, the poor reaction may be due to that. Perimetry tests show extreme uniform bilateral contraction of the visual fields, typical barrel vision. Vision: Right 6/12, left 6/21. Pupils clear, slightly dilated; media clear to ophthalmoscope, optic disk completely obscured by swelling amounting to 4 to 5 diopters in the right and 5 to 6 in the left eye; bilateral papillitis.

III, IV, VI. No paralyses or pareses of the occular muscles.

V. Bilateral corneal reflex, no facial anesthesia, masseters contract firmly and equally right and left.

VII. No weakness of the facial musculature right and left.

VIII. Both tympani slightly retracted, cones of light good, no pain in ears; no discharge; hearing 20/20, AC>BC both sides, Weber =, no mastoid tenderness.

IX. Sense of taste difficult to determine, but apparently normal.

X. Gag-reflex normal, palate raised normally right and left, uvula not deflected.

XI. Raises both shoulders equally and well; no sternomastoid weakness.

XII. Tongue protrudes normally in the midline, no atrophy.

Extremities.—Arms: No wasting or paralysis of movement. All muscle movements powerful and equal right and left. No dysmetria finger-to-nose or finger-to-finger; no astereognosis, adiadokokinesis, or loss of sense of position or passive movement; no loss of the finer movements of fingers right or left. No sensory loss in the upper extremity.

Reflexes.	Right.	Left.
Biceps	3	3
Triceps	3	3

Thorax: No sensory loss.

Abdomen: No sensory loss. Abdominal and cremasteric reflexes prompt and equal right and left.

Legs: No wasting or paralysis of movement. All muscle movements powerful and equal right and left. No dysmetria heel-to-knee, no loss of sense of position in the toes, no Romberg, no abnormalities of gait or station, no loss of vibratory sense. No sensory loss noted.

Reflexes.	Right.	Left.
Patellar	3	3
Achilles	3	3
Babinski	0	0
Clonus	0	0

11/3/22: Apparently deviation of the movement of the right eye to the nasal side and, consequently, defective convergence. Slight weakness of the left side of the mouth in movement noticed. Blood and urine negative to repeated examination.

Wassermann test on blood and spinal fluid negative in all dilutions on two examinations. Spinal fluid pressure 25 mm. Hg.; 3 cells per H. P. F. Queckenstedt test negative. *x*-Ray of skull negative. No pituitary fossa enlargement.

Summary of Positive Findings.—Severe headaches, at first occipital, then frontal, especially on the left side.

Loss of vision, bilateral papillitis more marked on the left.

Slight limitation of movement O. D. to nasal side and defective convergence.

Slight weakness of left side of mouth.

Tenderness to percussion over left frontal region.

Tentative Diagnosis.—Brain tumor—position undetermined.

10/30/22: Ventriculogram. Patient on face, head turned to the left, trephine opening in the right parietal region under local anesthesia. Right ventricle tapped, pressure of fluid 20 mm. Hg.; 30 c.c. of fluid withdrawn; pressure 10 mm. Hg.; 40 c.c.

of air injected, pressure in ventricles 40 mm. Hg. Taken to the *x*-ray department and four plates made, right and left; lateral, A-P and P-A. Air removed after plates were made. Except for slight headache, the patient had no reaction after this procedure.

Ventriculogram Diagnosis.—In the A-P view (Fig. 94) the left ventricle seems entirely occluded, but in the P-A view (Fig. 95) the posterior horns of both ventricles are patent and filled with air. In the lateral view (Fig. 96) the posterior horns of both ventricles are well filled, but the anterior horns, especially the left, seem to be obstructed. It would appear that the anterior horn of the left ventricle is shut off. Coupling this fact with the persistent left frontal headaches and tenderness to percussion in this area, and the more marked papillitis on the left, it seems probable that the tumor is in this locality. For this reason it

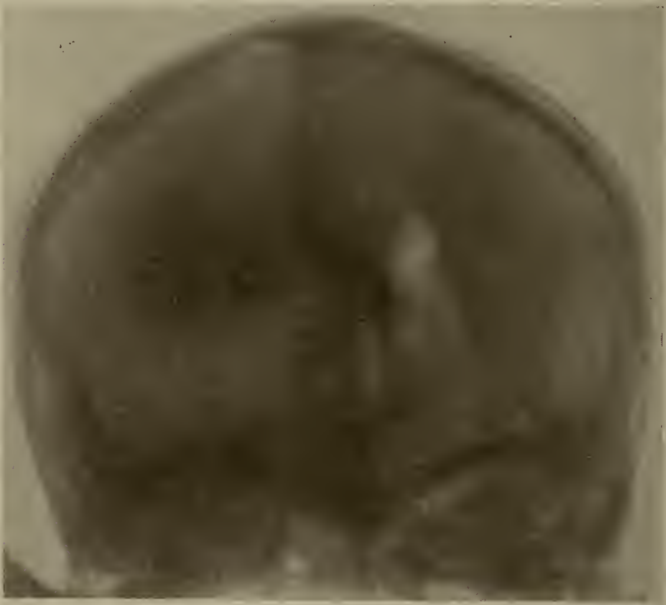

Fig. 94.—Anteroposterior *x*-ray plate showing the complete occlusion of the anterior horn of the left ventricle, while the anterior horn of the right fills normally.

would be advisable to raise a left frontal osteoplastic flap, and if no tumor is found, to perform a decompression under the base of it in the left frontal region.

11/7/22: Tendon reflexes on the right side slightly increased over left. Pseudoclonus on right. Babinski on right, none on left. Abdominal reflexes equal on two sides. Right grip weaker than left. Investigation of cranial nerves difficult on account of lack of co-operation. There is considerable mental uncertainty manifested not only in lack of co-operation but also inability to understand commands. This seems more than can be accounted for by the language difficulty and an indifference to the presence of the examiner. Frequently puts left hand to head and moans. Evidence at present indicates a slight disturbance in the left motor cortex, either as the result of the ventriculogram or due to the encroachment of a tumor.

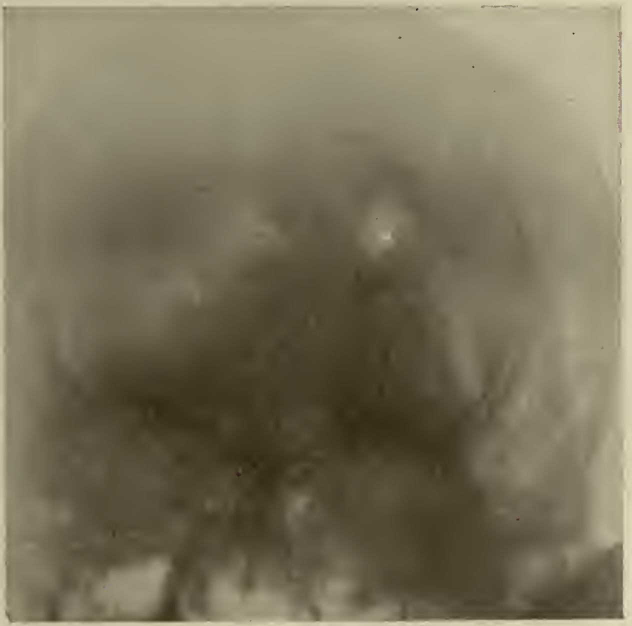

Fig. 95.—Postero-anterior *x*-ray plate made after filling up the ventricles with air. The posterior horns and bodies of both ventricles are shown to be patulous.

Operation.—11/13/22.—A large left frontal osteoplastic flap was turned back under endopharyngeal ether anesthesia. The flap extended from just behind the Rolandic fissure to the eyebrow and from the midline to the base of the skull in the temporal region. There was but little bleeding while the flap was being laid back, as the area had been blocked off with novocain and adrenalin. The dura was extremely tense. An attempt to tap the ventricle on the left side was made, but instead of entering the ventricle, a small cyst containing about 5 to 10 c.c. of a clear yellow fluid was encountered. This was significant of a gliomatous tumor which had become cystic. The tapping of this cyst did not in any way relieve the dural tension. For this reason we tapped the ventricle on the right side. In this we were successful, and the dural tension was somewhat relieved; not sufficiently, however, to turn back a large dural flap. We therefore made a segmental opening of the dura, and noted that the cortex was of a yellowish color, rather pale, and the convolutions

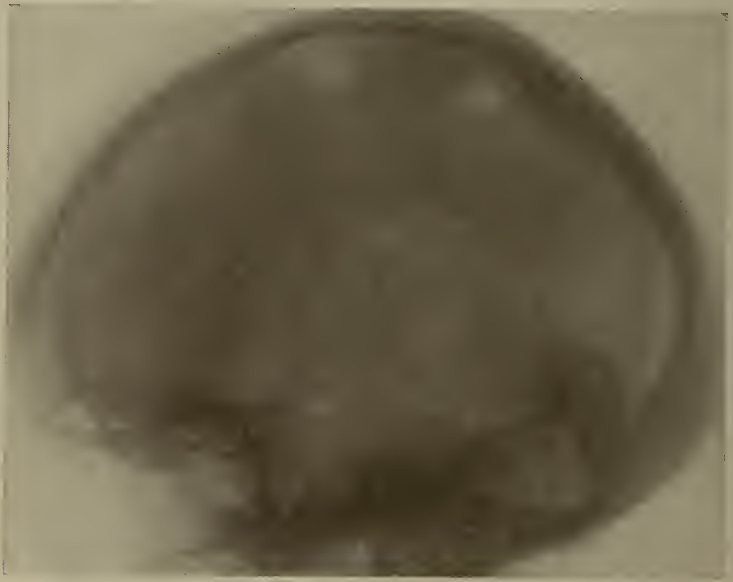

Fig. 96.—View of left lateral ventricle showing that the body and posterior horn are well filled with air, but that the anterior horn is not filled.

flattened out. The brain commenced to herniate as soon as the dura was opened and, considering the nature of the tumor, we determined to close the dura and replace the bone-flap, after filling the cyst with air for the purpose of discovering its exact location. After some trouble the dura was closed. An attempt to locate the cyst with an exploring cannula resulted in the evacuation of a larger and deeper cyst, about 30 c.c. of a similar fluid being removed. The dural tension now entirely disappeared. Thirty-five c.c of air were injected into the cyst and the flap replaced. The patient was taken to the *x*-ray department and

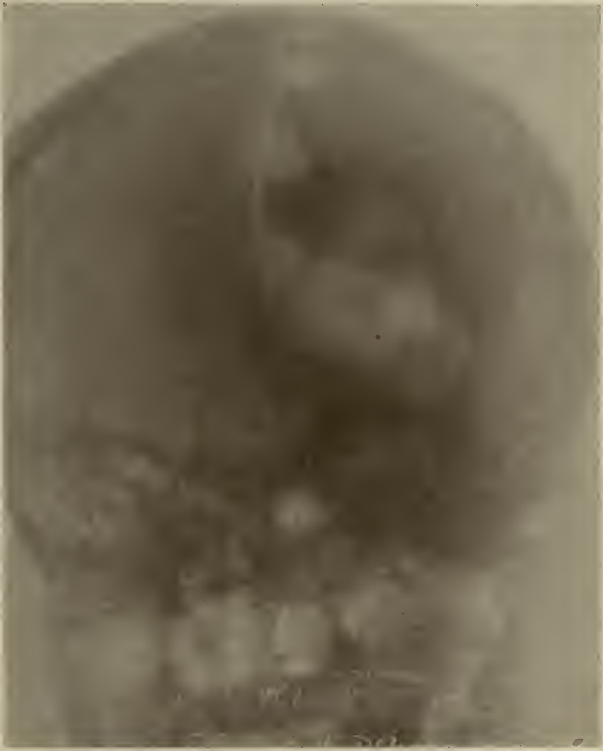

Fig. 97.—Anteroposterior plate made on the operating-table after the cyst cavity had been filled with air. The dimensions of the cyst in this plane are clearly visible. The trephine openings and the edge of the osteoplastic flap are also shown.

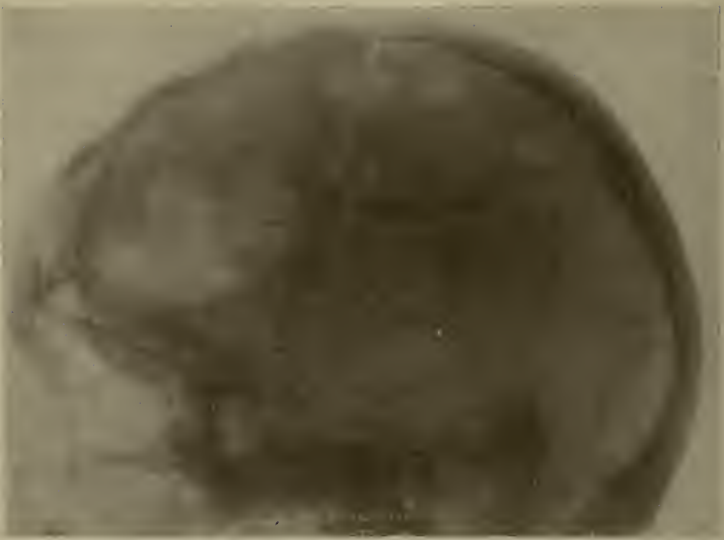

Fig. 98.—Lateral plate made on the operating-table showing the area of the cyst in the lateral plane.

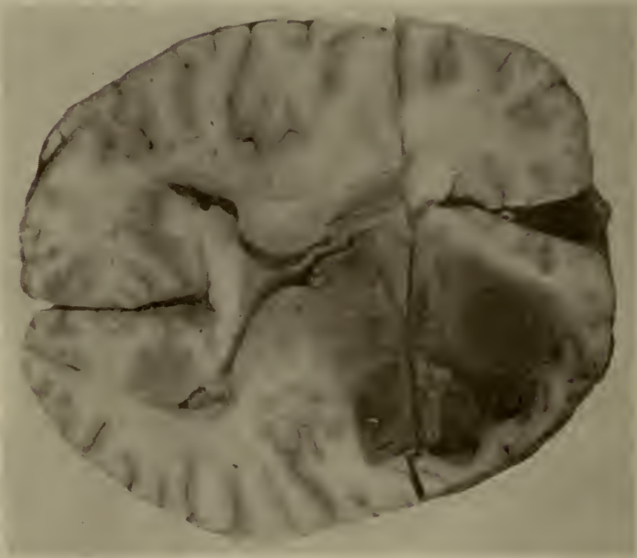

Fig. 99.—Photograph of the brain at autopsy. The brain has been sectioned in the horizontal plane. The tumor is seen in the left frontal lobe, occluding the anterior horn of the ventricle. The body and posterior horn of this ventricle may be seen to be patulous, while the right ventricle is shown to be entirely free. The cystic degeneration which the tumor has undergone is well shown. The upper half of the brain section is seen.

lateral and anteroposterior plates made to outline the position of the cyst (Figs. 97, 98). The patient was then returned to the ward in good condition. There was no marked postoperative reaction. On the second day the wound was dressed and found in good condition. The patient was clear mentally—a favorable sign in gliomatous cases—but rather restless. He strained a great deal while being dressed. About sixty hours after operation he suddenly sat up in bed, fell back unconscious, and died in three hours. At autopsy the operative field was in good condition. The tumor seen in the plates was found (Figs. 99–101). Pathologic report: Gliosarcoma.

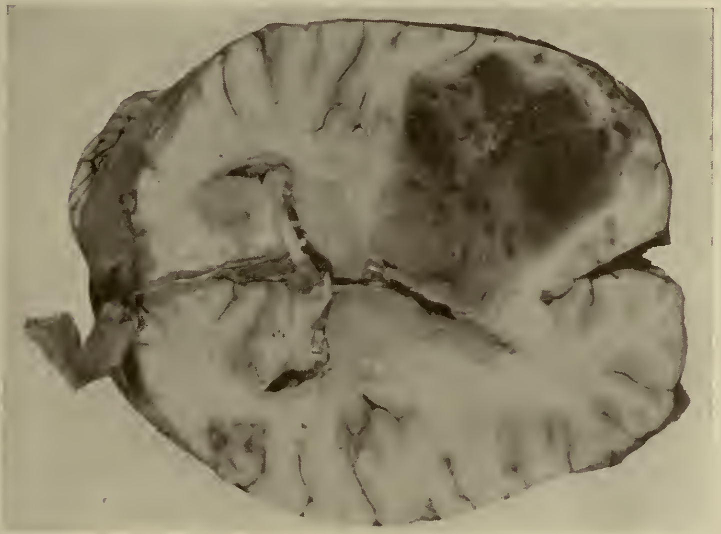

Fig. 100.—The lower half of a horizontal section through the brain. The tumor and its relationship to the anterior horn of the left ventricle is shown.

Comment.—This case demonstrates the size to which a gliomatous tumor of the brain may attain without producing other than pressure symptoms if located in a silent area of the brain. The absence of any motor speech loss seems remarkable, but close questioning of the patient's wife before his death revealed the fact that he had never seemed to have any difficulty in articulation. It is problematic how long the tumor had been present. The onset of symptoms dated only two months prior to admission, the history of the blindness of fourteen years before, which soon cleared up, has, in our opinion, no bearing on the present condition, but from the size of the growth and the amount of cystic degeneration it had undergone he must have carried the lesion for a much longer time than that.

Two conditions in which the injection of air may be of very definite value are made manifest. The ventriculogram showed that the anterior horn of the left ventricle was occluded. This fact placed the pathology in the frontal lobe, for the body and posterior horn of the left ventricle was filled with air, showing that the foramen of Monro was patulous. The air injection of the cyst determined its dimensions and exact position. Had the outcome been more fortunate, we would have been able to treat the lesion with intelligence. But with a gliomatous growth of this size the prognosis would have been extremely grave.

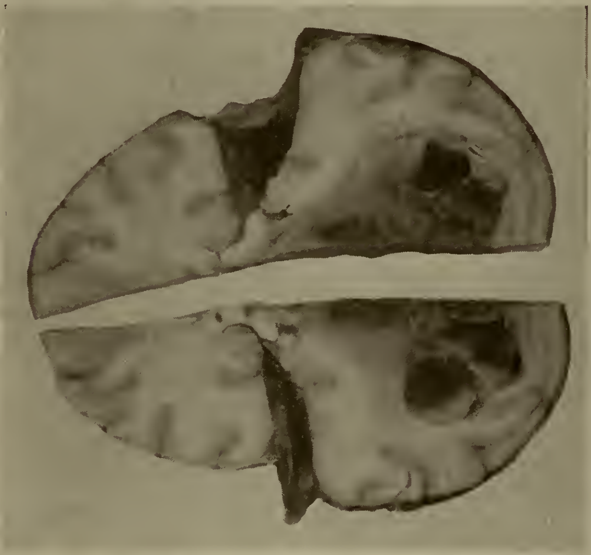

Fig. 101.—Frontal section through the brain through the center of the tumor to show the size of the cyst and the distance of the growth from the surface of the brain.

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CLINIC OF DR. FRED H. ALBEE

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UNUNITED FRACTURE OF THE LOWER JAW WITH OR WITHOUT LOSS OF BONE

Very little information on the treatment of maxillary fracture is found in the works of early writers on surgery. This is probably due to relative scarcity of these lesions and the difficulty of treatment. What little information is found is on the inferior maxilla.

Hippocrates (460–377 B. C.) distinguished between complete and incomplete fractures. In his classical books, "De Fracturis" and "De Articulis," he dealt with surgery and gave these fundamental principles:

"1. That in surgical affections there are the same movements and spontaneous proceedings of recovery as in medical affections.

"2. That the surgical therapeutics must proceed like the medical with simplicity, imitating nature and operating jointly with it; the surgical operator making it possible for nature to accomplish the recovery of the lesion, which pre-existed the operation, and restore that which was made by the instrument."

Adapting these principles to that of mandibular fracture, Hippocrates says:

"If the reduction has been well performed, the part kept in proper repose, the consolidation takes place in a short time and the teeth do not undergo any damage. In the contrary case the cure is retarded, the fragment reunited in bad position, and the teeth are useless."

In order to retain fragments of bone in right position he ligated the teeth proximate to fracture preferably with gold wire or linen thread. Two straps of Carthagin leather fixed the chin.

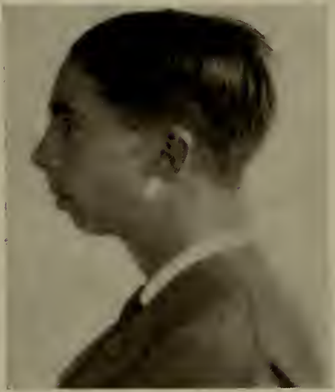

Fig. 102.—Case S. I. Lateral view, demonstrating receding chin.

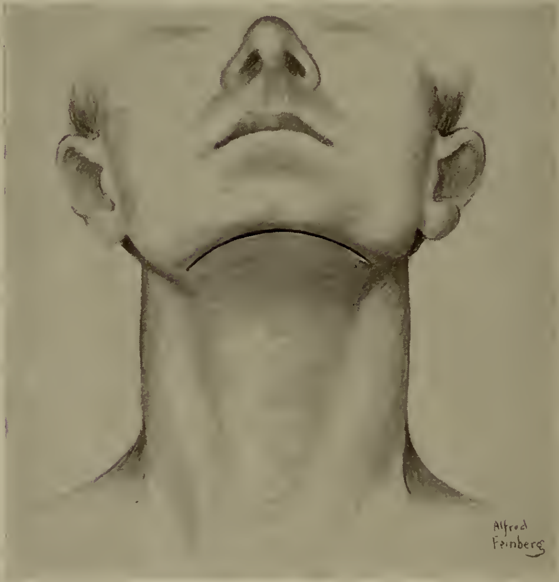

Fig. 103.—Case S. I. Demonstrates effacement of incision so as to avoid objectionable scar.

Directly after Hippocrates we find few new ideas, and these only a modification of his methods. Aulus Cornelius Celsus (about 30 B. C.), in the seventh chapter of the eighth book of his Medicine, says:

"In fracture of mandible we must, first of all, replace the fragments to their normal position. Then, in case of transverse fractures, it is necessary, after having set fragments in place, to tie together the two teeth nearest to fracture with silk thread. After this one should apply externally, to part corresponding to lesion, a thick compress dipped in wine and oil and sprinkled with flour and powered olibanum. This compress is to be fixed in place by means of a bandage or strip of soft leather, with a longitudinal slit in middle to embrace chin, the two ends being

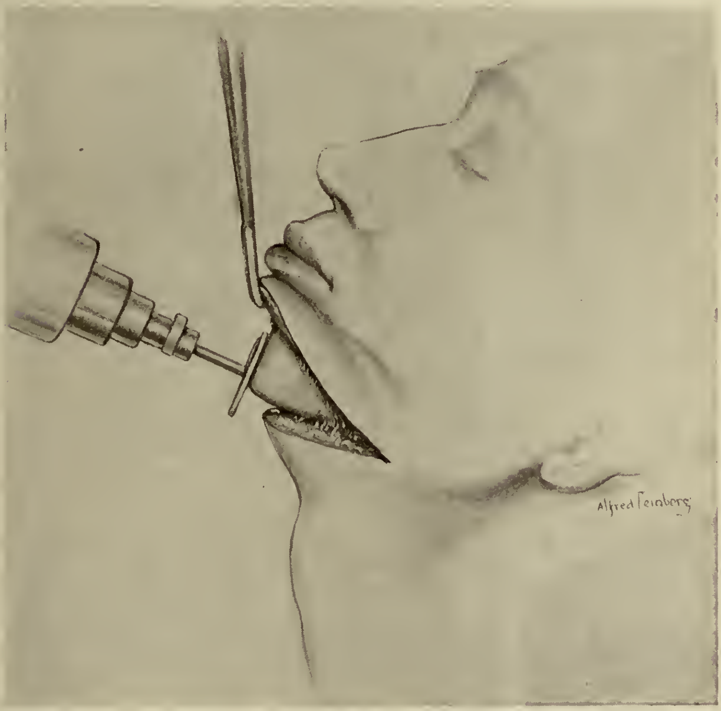

Fig. 104.—Case S. I. Demonstrates advantage of a motor saw in shaping a flat surface on anterior surface of jaw to receive bone-graft. (See Fig. 105.)

tied together above head. Fractures of lower jaw and of maxillæ commonly heal from the fourteenth to twentieth day."

Here, by Celsus, is first mention of sling for chin, erroneously attributed to Galenus (131 A. D.). This bandage was really a perfecting of Hippocrates' method. It is also described before Galenus by Soranus of Ephesus, Junior (97 A. D.).

Among the Arabians, Avicerina, in the Middle Ages, is still considered among some of the orientals as the greatest teacher of medicine. He wrote a chapter on mandibular fractures in which he emphasized one important point of interest. He urged that after first aid to the injured had been given the operator should be called in order to re-establish the level of the maxillary arches. He describes the bandage of chin very well: "Put the two ends from the two sides over the head to the end of the mandibula, then from here again to the nape of the neck; then to the place below the chin and over the two maxillary bones

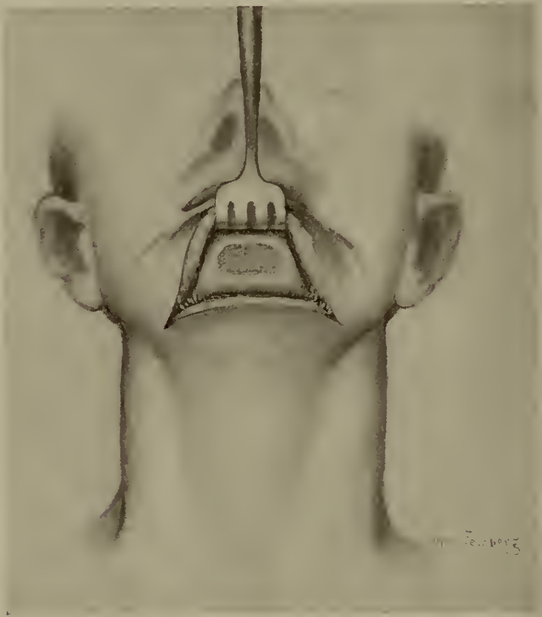

Fig. 105.—Case S. I. Anterior aspect of jaw freshened, ready to receive bone-graft.

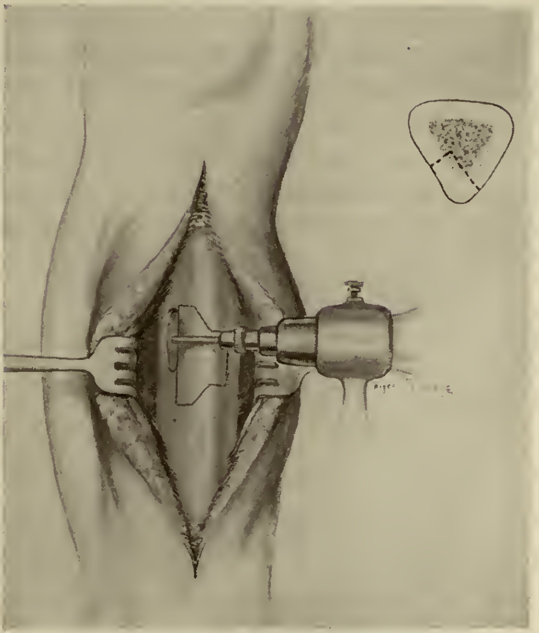

Fig. 106.—Case S. I. Indicates shape of bone-graft and method of obtaining and molding it with Albee bone-mill.

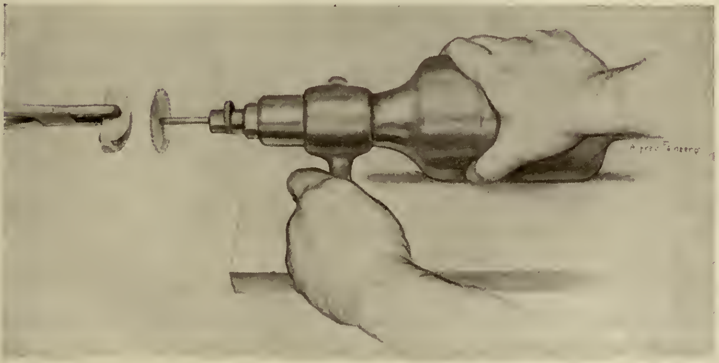

Fig. 107.—Case S. I. Demonstrates further shaping of graft for cosmetic purposes and method of accomplishing it. The graft is tentatively placed *in situ* on tip of jaw, and skin with subcutaneous tissue is drawn over it with Allis' clamps. The contour of the chin thus formed is studied and the desired cosmetic changes are accomplished by removing the graft and additionally shaping it as shown here.

to the crown; from here again to the place below the nape of the neck; and put another ligament over the forehead and across the back of the head and fasten everything; and put over all a soft cloth."

In 1180 at Salernum was compiled the text-book of surgery called Mæstro Ruggero, from Parma, which, with the notes added in thirteen and fourteen centuries, constitute the greatest book on surgery of the so-called "scholastic medicine." In it the following treatment of mandibular fractures is given under the heading of poultices and liniments:

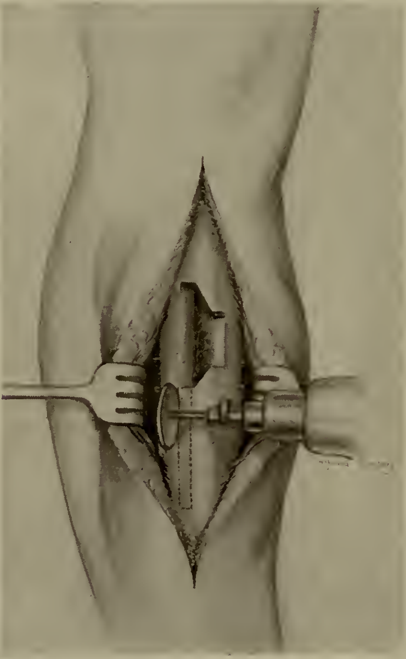

Fig. 108.—Case S. I. Demonstrates from where bone for dowel peg was obtained and method of securing it.

"Take olibanum, mastic, colophene, glue, dragon blood; all this must be mixed with liquefied resin and becomes ointment, which is placed over the teeth till the complete consolidation, and everything must be fixed with the little lances in order that the portions be prevented from moving out of place."

In 1275 Wilhelm, from Piacenza, wrote in Verona the Praxeos Totius Medicinæ, in the second part of which (Surgery) he speaks of fractures of the mandible, and advocates binding teeth proximate to the fracture not only between themselves but also to the corresponding teeth of the maxilla.

Ambrose Paré, the great French surgeon, who lived between 1517 and 1590, modified thus the so-called Galen sling: "There will be applied a leather ferrule, such as from which the soles of a boot are made, which has been divided in the middle at the level of the chin, long and wide as the mandible; and there will be made a ligature with a band, two fingers wide and as long as necessary, cut at the two ends, leaving only 1 inch, and at the level of the chin it will be parallelly cut, for the purpose of embracing and pressing better over the chin; once at the torn extremities, the shorter will be sewed at the top of the head to

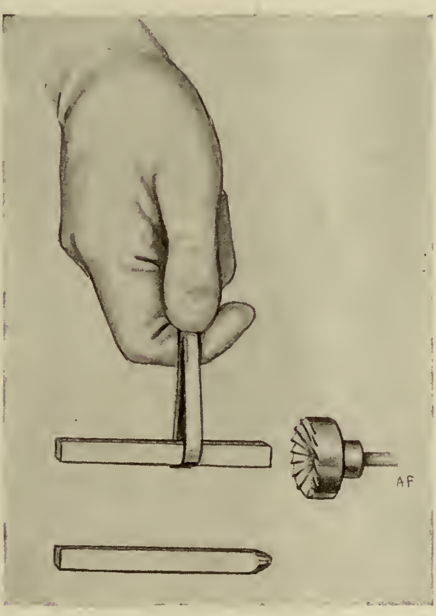

Fig. 109.—Case S. I. Method of producing a conical end by means of Albee bone-mill on the graft to be later shaped into a dowel peg. The purpose of this is so that it will drive into drill hole easily without corners catching, also so that it will engage satisfactorily in dowel shaper. (See Fig. 110.)

a night-cap or calotte, and the other two longer ends will be kept transversely and sewed behind the same cap, everything done as skilfully as possible in order to hold well the fracture."

Fabricius, from Aquapendente (1600), advocates supplying the inefficiency of the sling of the chin with two, when already Teododicus, of Bolonga (13th century), had thought to supply it with a small cushion.

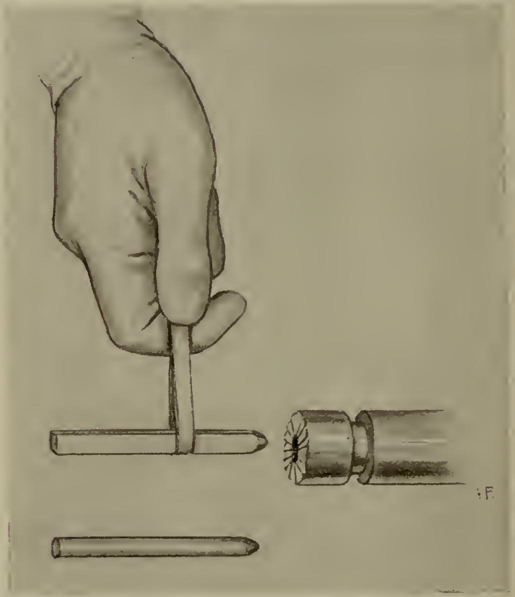

Fig. 110.—Case S. I. The conical cutter has been removed and the dowelling cutter has been put in its place. The graft has been shaped into a dowel, as shown in lower drawing. This procedure of shaping graft has consumed but a few minutes.

Robert Benson (1743, French), in his treatise on diseases of teeth, relates 2 cases of fracture of lower jaw which he succeeded in curing in a short time by method of binding the teeth. One of these cases: site of fracture correspond with bicuspids, which had fallen out as result of trauma—neighboring teeth also loosened. Benson filled empty space left by bicuspids with piece of ivory provided with two holes. By ingenious crossing of threads from second molar on one side to second bicuspid on other, tightly tied, he formed a single block and succeeded in bringing about consolidation of teeth and complete cure of fracture in less than a month.

In the middle of the 18th century bandages of chin were still in fashion. Gradually they came to realize that they should combine the sling with a point of support on the chin. With Chopart and Desault (1780) begins an era of scientific treatment of fractures of the maxillary bones.

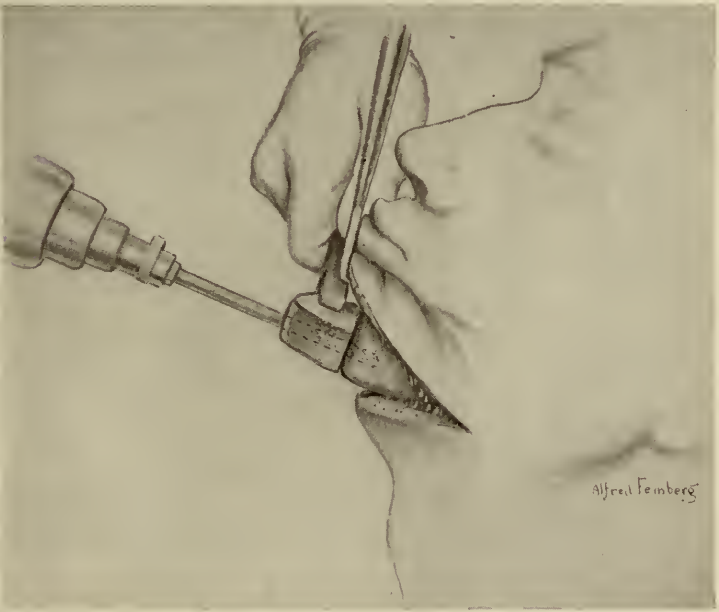

Fig. 111.—Case S. I. The graft and jaw is being drilled with the proper sized drill to receive the dowel peg graft.

The possibility of correcting a hideous distortion of features or of replacing a large section of the human face was not fully realized until the great European War produced so many mutilations. The public at large and even a considerable number of members of the medical profession were unfamiliar with the advances made in plastic surgery. Military surgeons were soon confronted with problems with which they were unfamiliar; but they quickly used, with ever-increasing skill, the reparative methods of Tagliacozzi, Szymanowski, Nélaton, Wolf, Lexer, Morestin, Esser, and others. . . .

Reparative surgery of face follows identical methods for reconstruction of wounds received in warfare and those caused by industrial accidents.

In extensive osseous injuries the bones should be accurately adjusted and held in position, if necessary, by kangaroo tendon sutures, strong wire on teeth, as interdental splint.

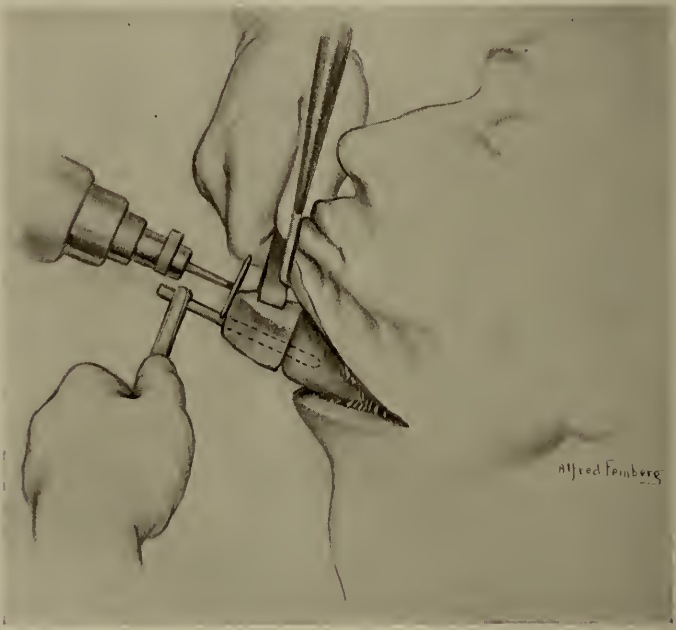

Fig. 112.—Case S. I. The fixation dowel peg graft, having been driven into place through the graft and into the jaw, is being severed flush with anterior surface of graft. The end of the remaining portion of the graft dowel is then made conical with bone-mill as in first instance for second fixation dowel.

Early replacement of displaced soft parts with co-operation of dental surgeon is important. It is easier to prevent facial deformities by immediate reproduction of at least a semblance of anatomic correctness. Few general surgeons have had surgical training to manage the immobilization of jaw by interdental splints.

When great masses of skin, muscle, and even bone have been torn away, there sometimes remains a hinge-like attachment to head or face. This form of injury will sometimes permit replacement of tissues. It may be possible to attach a band of metal to head and from this carry a spring with a pad to press the loosened tissue against the region to which it should be sutured. Tacks may be used to nail such a flap in position if firm bone underlies it.

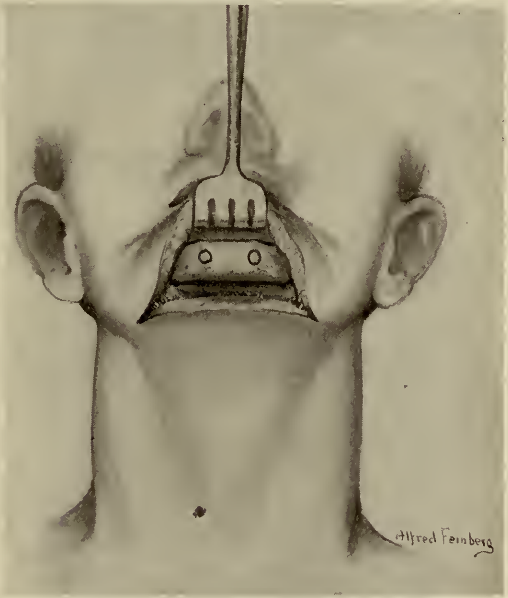

Fig. 113.—Case S. I. Anterior view after graft has been firmly fixed in place by means of two dowel peg grafts.

Northcroft's statistics demonstrated that fracture of the mandible as compared with fracture of the maxilla occurred in a ratio of $4\frac{1}{2}:1$. Fracture of the mandible, as compared with fracture of both upper and lower jaw, were in the ratio of $9\frac{1}{2}:1$.

The problem of pseudo-arthrosis, frequently encountered in these cases, has been in the past a baffling one.

Repair of fracture of the lower jaw, with or without loss of substance, involves fundamental orthopedic principles. One of

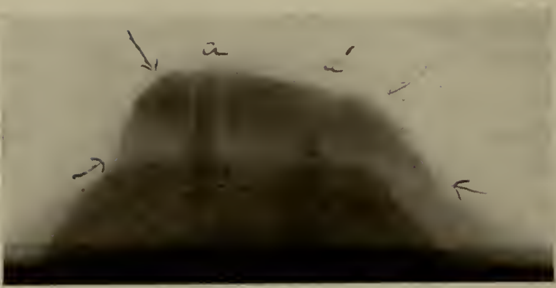

Fig. 114.—Case S. I. Demonstrates superior view of tibial graft two months after being placed on anterior surface of the lower jaw as indicated by arrows: *a a'* indicate anterior ends of dowel grafts, pegging large graft to jaw.

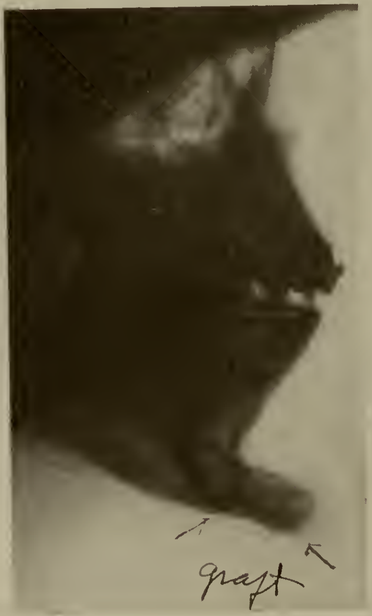

Fig. 115.—Case S. 1. Lateral *x*-ray taken three months after implantation of graft. The arrows indicate the width of the graft and the remarkable way it has united to the jaw.

the primary objects of the surgeon is the prevention of deformity always associated with untreated cases of loss of bone of the

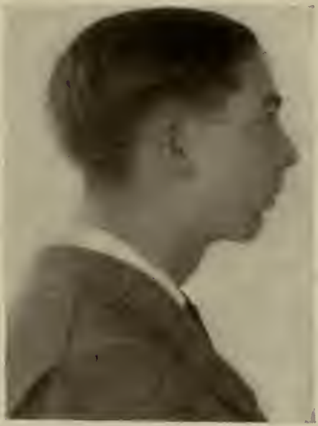

Fig. 116—Case S. I. Lateral view taken four months after operation, and indicates the amount to which the chin was enlarged.

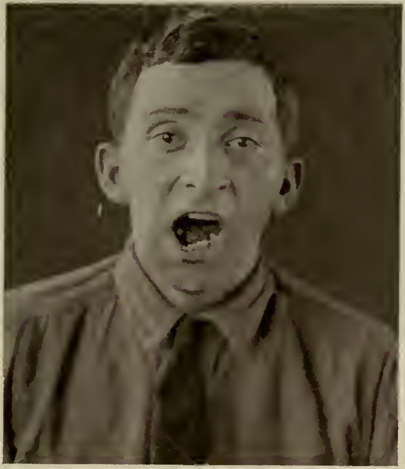

Fig. 117.—Case A. C. Age twenty-eight. Soldier A. E. F. Compound comminuted fracture of right rami of lower jaw at Soissons July 21, 1918, by machine gun bullet. Wound healed August 23, 1918. An inlay bone-graft from the right tibia was done on this case at U. S. A. General Hospital, No. 3, Colonia, N. J., by the author on February 5, 1919. The convalescence was uneventful. An interdental splint was worn for two months after operation. Firm union of the graft to the jaw fragments occurred in seven weeks' time. The result was most satisfactory, with complete restoration of function. This photograph shows both loss of teeth and faulty alinement of jaw fragments before bone-graft operation.

jaw. As in other orthopedic procedures, the mechanical control of the jaw fragments and the necessity for prevention and correction of the deformities and distortions resulting from the solution of continuity is emphasized. The modus operandi of their causation is identical with deformities occurring at the knee or hip as follows:

The mechanical displacements of the fragments following fracture of the jaw, with or without loss of substance, are caused in precisely the same way as fragments displaced in a fracture of the femur or other extremity bone. The solution of mechanical continuity results in the unbalancing of the muscle control. For instance, it may occur that all the adductors are attached to one fragment, while all the abductors are attached to another. This means, necessarily, a displacement in alinement of the fragments, providing no mechanical influence is used to prevent it.

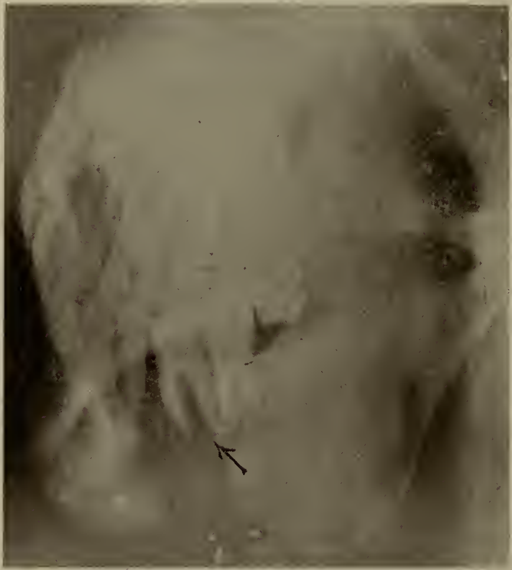

Fig. 118.—Case A. C. Roentgenogram of lower jaw, showing actual loss of substance, over 1 inch. Note that one of the teeth is attached to the soft parts in the gap between the jaw fragments.

The same applies to the displacement of the jaw fragments,

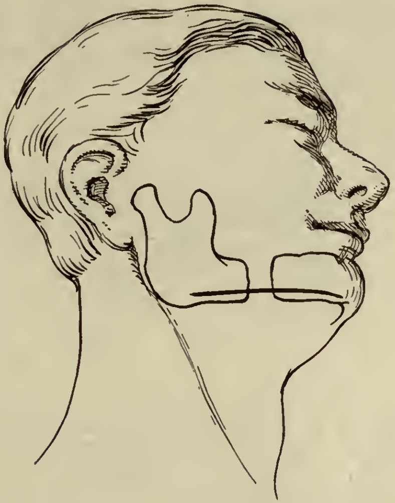

Fig. 119.—Case A. C. Showing the line of the skin incision in relation to the jaw fragments.

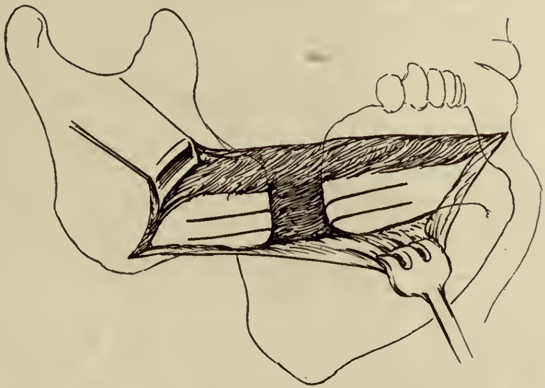

Fig. 120.—Case A. C. The soft parts have been retracted from the jaw fragments. By means of the twin-saw, with the blades set about ½ inch apart, parallel saw-cuts have been made in each fragment for a distance of about 1 inch from the ends and extending down into the marrow. Cross-cuts are then made at the termination of the parallel saw-cuts and the strips of bone included within the saw-cuts are removed to form the bed of the proposed inlay bone-graft by means of narrow osteotome, motor-burr, end-mill, or drill, as shown in the following figure.

and the principle involved in the reduction of the displacement and the maintenance of the bony fragments in their proper alinement are the same. In other words, the work simulates in every respect osteoplastic orthopedic work done in other parts of the body.

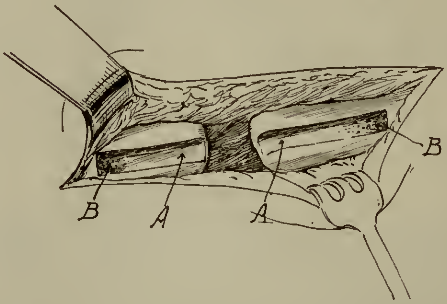

Fig. 121.—Case A. C. Showing the jaw fragments laid bare, with the gutter formed for the reception of the inlay graft, which is to restore the continuity of the jaw: *A* indicates eburnated bone which fills the marrow cavity at the ends of the fragments; *B* shows the region of the marrow. Note that the gutter has been made sufficiently long for the purpose of opening up the healthy marrow section. The adequate contact of marrow of graft with healthy marrow substance of host is an important feature in the successful growth of the graft and its union.

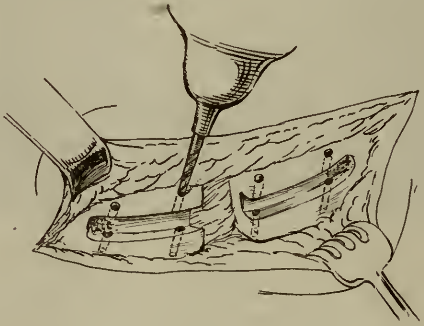

Fig. 122.—Case A. C. On account of the thinness of the jaw fragments, and the danger of penetrating the oral cavity in the separation of the soft parts and the important structures of this region, drill-holes are made as indicated: in the superior part of the gutter the drill is entered at the top of the gutter and so directed that the holes come out on the inside. In the lower portion the drill holes are made so that they enter the bottom of the gutter and come out underneath.

If a deformity has already occurred, there should be continuous applied pressure. The contraction of the maxillary joint is corrected in the same manner as that of the hip-joint by constant pressure being brought to bear in the proper direction by a specially devised splint which shall correct the deformity. The muscles of mastication are constantly drawing the bony tissues inward and this should be controlled at the earliest possible moment.

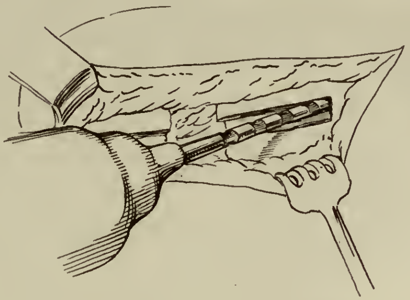

Fig. 123.—Case A. C. Having removed the strips of bone, the formation of the gutter is completed by means of a medium-sized motor-drill. In this type of work the motor-drill is of great advantage, owing to the hardness of the jaw-bone and the necessity for securing an accurate fit of parts.

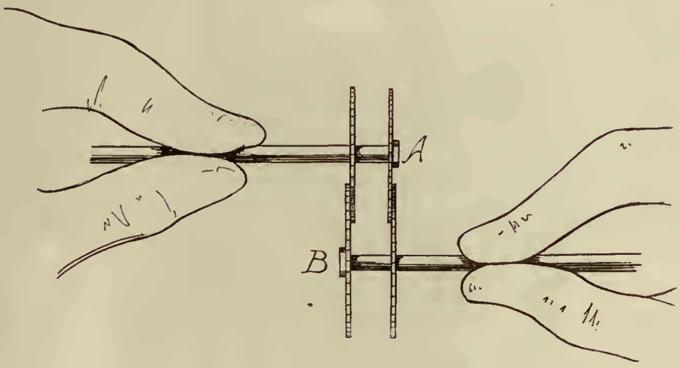

Fig. 124.—Case A. C. The blades of the twin-saw, *A*, are adjusted to make the walls of the grooves in the jaw fragments, into which the graft is to be fitted. The blades of the twin-saw, *B*, are adjusted to remove the inlay graft from the tibia. It will be noted that the saw-blades of *B* are set at a distance exceeding that of the saw-blades of *A* by just twice the thickness of the blade. By the adjustment of the saw-blades in this manner a *snug* fit of the graft in its bed is assured. If the twin-saw is used unadjusted, in the removal of the graft and in the formation of the bed, it would result that the graft is twice the thickness of the saw-blade smaller than the width of the bed, that amount of bone being lost in sawdust. The above scheme is devised to avoid such an event.

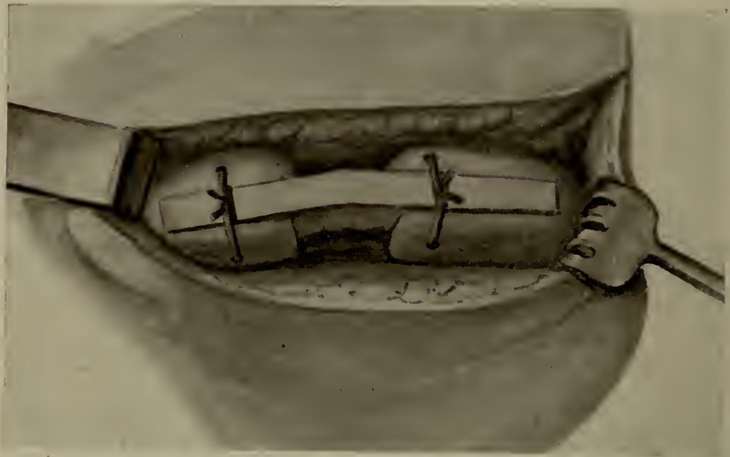

Fig. 125.—Case A. C. Showing the inlay bone-graft in place, with kangaroo-tendon ligatures holding it. Note its slight angulation in contour which adapts it to the jaw fragments, restoring over 1 inch of bone loss.

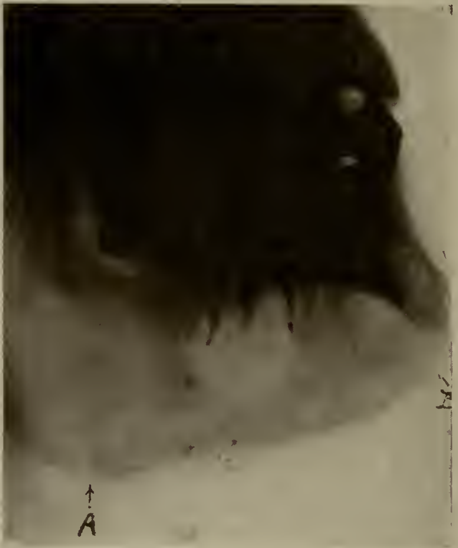

Fig. 126.—Case A. C. Replacement of loss of bone in the lower jaw by a tibial inlay graft, indicated by arrows, *A–B*. This roentgenogram, taken three months after the plastic operation, shows union of the graft with the host fragments. The final results in this case were most satisfactory to the patient; there was perfect union and healing, with complete recovery of normal function.

In the early days of the war, where extensive separation of skin and soft tissues of face accompanied fractures of jaw-bones with loss of substance, the inclination was toward immediate closure of facial wounds by suture, little or no consideration being given to early correction of bony displacement.

As a result cases finally came to the oral and dental surgeon with soft tissues tensely united over deformed bones, and difficulties in correction were enormously increased. Now it is an acknowledged fact that "no attempt should be made to suture soft parts with idea of closing gap until such a time as union of fractured parts in correct relation is well under way and permanent splints are adjusted."

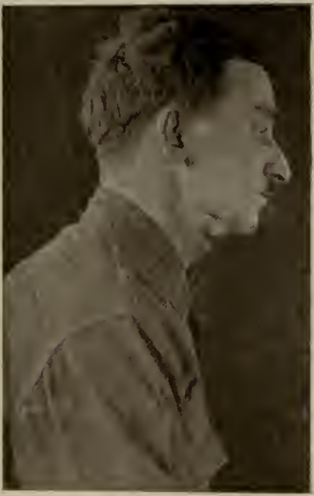

Fig. 127.—Case A. C. Showing patient about three months after operation.

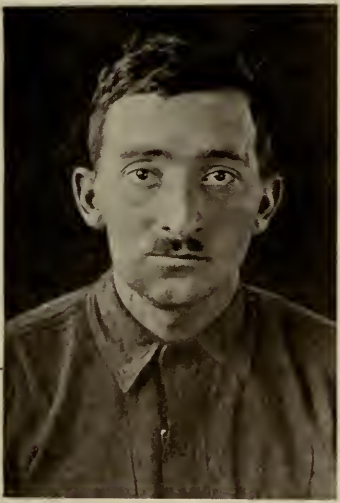

Fig. 128.—Case A. C. Final result, eleven months after restoration of over 1 inch of loss of bone in the right lower jaw by means of a tibial inlay. There was perfect union and the patient is able to functionate normally.

The Interdental Splint.—With the co-operation of the prosthetic dentist, an efficient interdental splint should be devised and applied as soon after the receipt of injury, or following the removal of bone substance for malignancy or other cause in order to prevent deformity. The dental splint should be used continuously, if possible, from the time of injury until the jaw is fully restored by the bone-graft, or until union is complete. Each case presents individual difficulties, and requires the combined ingenuity of a prosthetic dentist as well as a surgeon who not only is accustomed to deal with splints and mechanical problems, but is competent in osteoplastic technic as well.

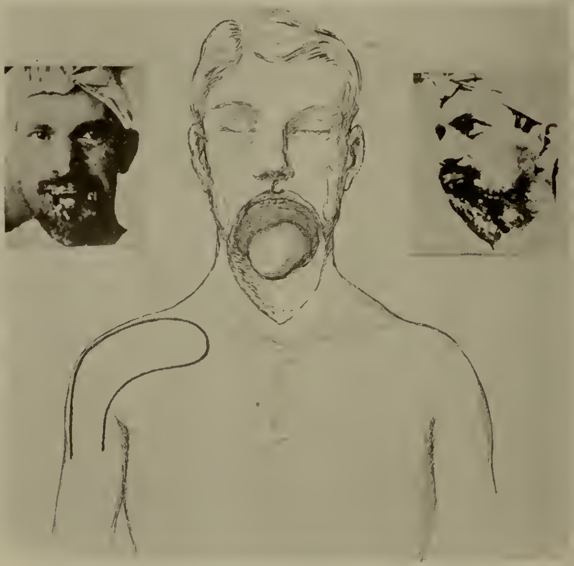

Fig. 129.—Case G. M. Destruction of lower jaw as result of exploding cannon. Loss of substance extended from last molar on one side to back of last molar on the other, and from pharynx to base of tongue. In this case restoration of the soft parts was accomplished before the transplantation of the bone . . . by means of a plastic flap taken from the shoulder, as shown in a following diagram.

In extensive cases of loss of bone difficult plastic surgical problems present themselves. This work may require numerous operations to bring forward skin and soft parts from the side of the neck or jaw to restore like tissues shot away or lost from infection. In the most massive cases extensive pedicle graft flaps from other portions of the body must be resorted to.

It should be noted that reparative work on the jaw is very favorable as far as the nourishment of the graft is concerned owing to the profuse blood-supply. The early and complete nourishment of the graft is a most important factor, and here we have very favorable conditions.

Various technical procedures have been advocated in the treatment of war injuries to the jaw. Notable among these methods have been the osteoperiosteal technic revived from the days of Ollier by Delageniere, and used by him more or less extensively; the pedicled graft advocated and used by Cole; the cartilaginous transplants of Morestin. In a recent treatise on the jaw Imbert and Real thus summarized work with bone-grafts on war cases in France and in Europe:

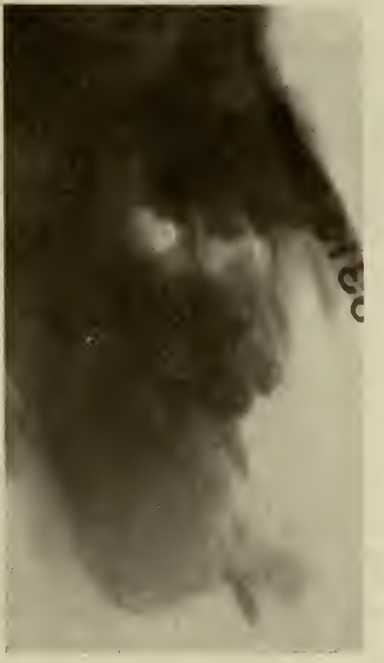

Fig. 130.—Case G. M. Roentgenogram, lateral view, showing loss of entire chin and lower jaw from last molar on one side to back of the last molar on other, as result of exploding cannon.

"We believe we are justified in concluding at the present moment that the results of bone-grafting in mandibular pseudoarthrosis are not yet demonstrated. They are *encouraging*—no more."

The above conclusions confirm a recent statement made to the author by a French surgeon who remarked that he had *never* seen a successful result from the osteoperiosteal bone-graft. The author takes exception to these foregoing statements, inasmuch as he feels that the fundamental principles of the bone-graft have not been taken into proper consideration in planning the procedure or in executing the technic by a large number of those who have reported failures through its use. With proper inlay technic a satisfactory percentage of good results should be obtained; the high vascularity of the soft tissues about the mouth is a most important feature, since the success of the bone-graft lies largely in the adequate blood-supply, which is not satisfactorily provided for by any other technic.

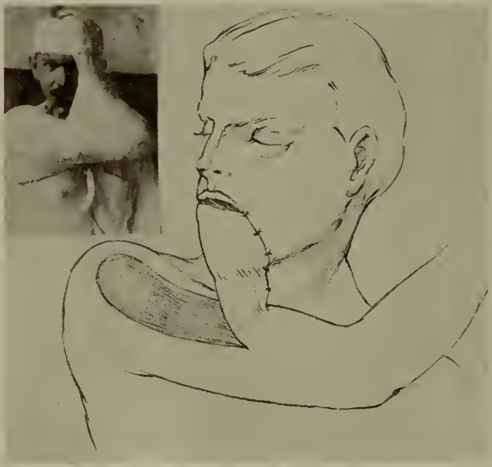

Fig. 131.—Case G. M. Showing the plastic flap taken from the soft parts of the shoulder, which has been attached to the soft parts of the face. The arm was held immobilized by a plaster-of-Paris head bandage in this position for a period of four weeks, which time is necessary for the union of the soft parts and the establishment of the blood-supply for the subsequent implantation of the bone-graft to restore the mandible. A secure immobilization of the parts is most important in all cases of pedicle grafts both as to results and comfort of the patient.

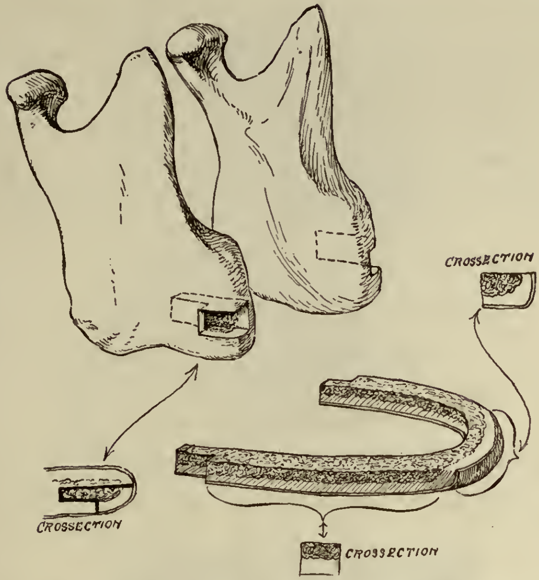

Fig. 132.—Case G. M. Showing the jaw fragments prepared for the reception of the large U-shaped graft, from wing of ilium, which restored the loss of substance in lower jaw from last molar on one side to back of last molar on the other. Note the shoulders which were cut in the ends of the grafts, to insure an accurate fit of the graft with the host fragments.

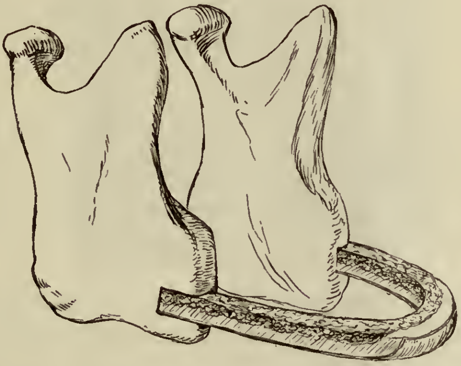

Fig. 133.—Case G. M. Showing graft from ilium in place in the ramus. Note that the shape and strength of this graft are sufficient to fix and hold the jaw fragments in the desired normal position, thus preventing the adduction of the fragments, which otherwise would inevitably result.

Moreover, another reason for failure in this type of work may, no doubt, be traced to the lack of proper armamentarium and inadequate experience therewith to carry out this most difficult technic. In work on the jaw, more than in any other part of the anatomy, great delicacy of technic is required; moreover, owing to the lack of anvil stability to the impact of the chisel and mallet, smallness of the jaw-bones and their irregularity of contour, difficulties are presented which can be satisfactorily met only by the means of a large variety of motor-driven tools. The bone is traumatized both by impact of hand tools and by long exposure to air and drying on account of the operative time being prolonged, also it is only possible to obtain

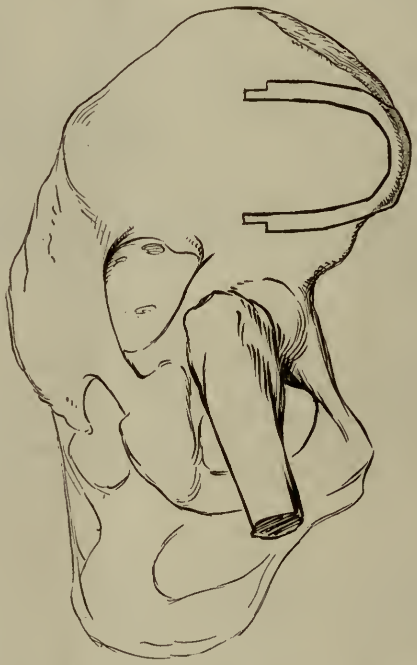

Fig. 134.—Case G. M. In this case, owing to the large amount of bone to be replaced, the only bone adequate as source of graft was the wing of the ilium. From this bone a large graft, U-shaped in contour, was taken to restore the lower jaw. The diagram shows the graft as mapped out in the periosteum of the ilium.

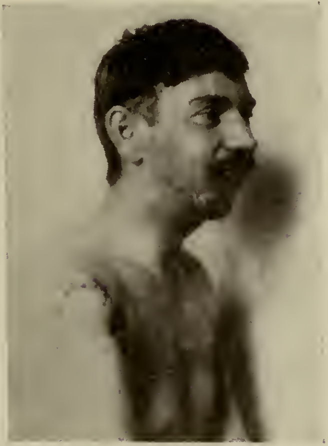

Fig. 135.—Case G. M. Photograph to show reconstruction of lower jaw by bone-graft and extensive skin-graft from shoulder.

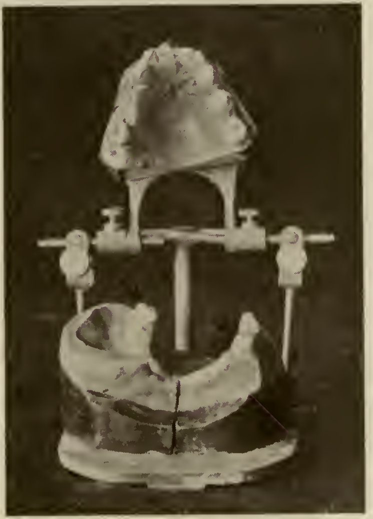

Fig. 136.—Case G. M. Plaster-of-Paris cast which was first molded from the actual condition of jaws in this case. Note that the last molar on the right is the only tooth which remained in the lower jaw following injury from exploding cannon. (See arrows.) From this plaster cast a special interdental splint was devised by Dr. Edward Kennedy of New York. As shown in the upper model, the upper jaw escaped injury. In the following figure the interdental splint is shown applied.

speedily accurate cabinet fits by means of automatic power-driven tools such as the author's bone-mill.

The osteoperiosteal type of graft in the years prior to the war had practically gone out of usage for the reason that men had tried it and had failed with it. With the advent of the war there arose suddenly a large group of cases of loss of jaw substance of relatively short duration, in which, in addition to the profuse vascularity of this region, there was no special reason for extensive loss of osteogenesis, and under such conditions favorable to its use the osteoperiosteal graft yielded a fair percentage of results, and its popularity, especially in France, became re-established.

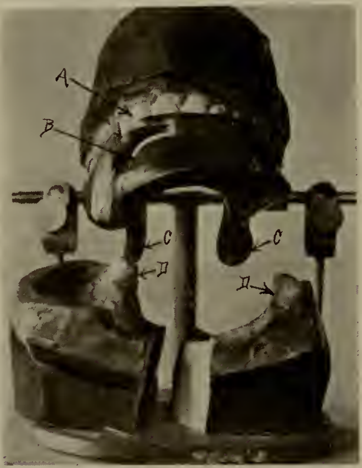

Fig. 137.—Case G. M. The splint is shown fitted to the upper jaw. *B* is an aperture left in the splint, through which a tube was passed for liquid feeding. The plaster cast of the lower jaw is shown split in two parts, being separated sufficiently to correct the adduction of the jaw fragments. The splint is seen fastened to the upper teeth with the flanges, or shoulders, *C*, projecting downward in such a manner that when the splint is in place and the upper jaw approximated with the lower, these shoulders come on the inner side of the end of the lower jaw fragments, at *D*. It was due to the pressure from these shoulders and the erosion of the mucous membrane overlying the end of the jaw fragments and the pain that necessitated the removal of the splint in this case within forty-eight hours. It should, however, be noted that owing to the type of graft employed the jaw fragments were held splendidly after removal.

Except in such cases as the foregoing osteoperiosteal graft should never be used alone. In fact, the author never uses it under any conditions, for it is not a complete osteogenetic unit. The author prefers at all times his "sliver graft" (described elsewhere) as supplemental to the main fixation graft.

Again, the sliver or the osteoperiosteal grafts are by no means adapted for cosmetic results in jaw work. . . . Only by means of a strong graft molded for this principle and firmly inlaid into each fragment can restoration of the proper contours of the face be accomplished.

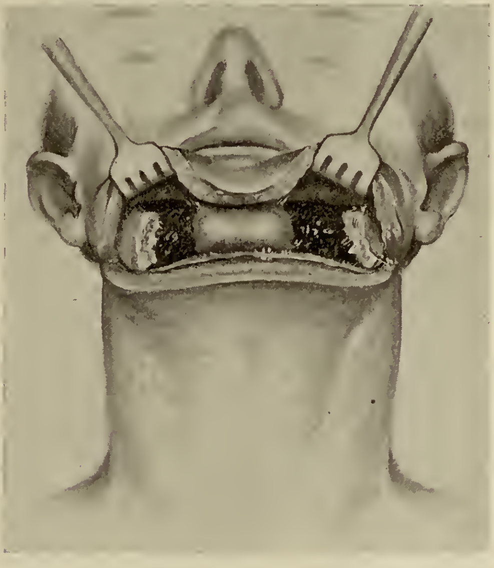

Fig. 138.—Case C. H. Demonstrates amount of bone absent on each side of jaw. There are only three teeth in central fragment and no teeth in the rami on either side.

The author feels from experience with over 3000 free bone-grafts on human subjects that the pedicle is neither necessary nor advisable even in the minority of cases in which this type of technic is feasible. It is apparent that in all cases where the loss of bone is extensive or when even a very little bone is absent if the pseudo-arthrosis is situated at a point where the contour of jaw is angular, the pedicle graft is not possible of application.

From an exact mechanical standpoint the pedicle graft falls far short of the ideal, (1) in that it cannot be obtained long enough to be inlaid or mortised into the jaw fragments even when there is not an extensive loss of bone; (2) in that it is entirely out of the question where there is an extensive loss of bone; (3) in that it does not offer possibilities of being molded to produce cosmetic results; (4) lastly, it does not furnish bone material of sufficient strength.

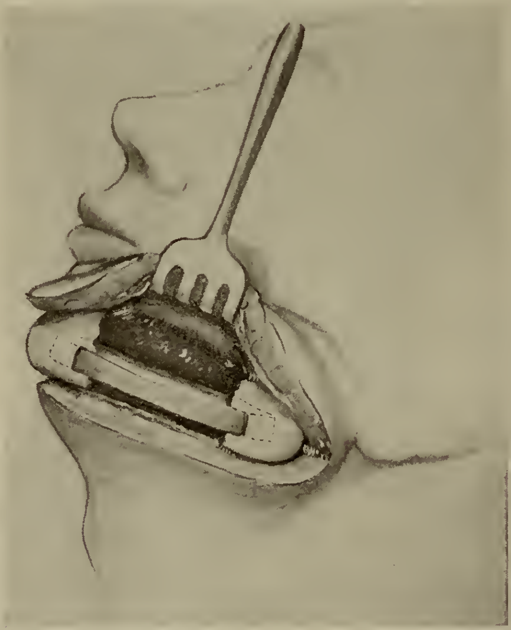

Fig. 139.—Case C. H. Demonstrates the inlay graft on the left side in place.

In fact, the inlay graft obtained from the tibia or ilium and molded by the motor-mill offers the only medium of securing satisfactory cosmetic results in extensive cases. This is illustrated by a case of the author's—an officer in the United States Army—when a previous attempt had been made to restore $1\frac{1}{2}$ inches of loss of bone of the right mandible by a pedicle graft. *x*-Rays taken a few days after the operation disclosed clearly the inadequate nature of the graft. It was not long enough to even span the hiatus, let alone an overriding contact with the jaw fragments. The result, as one would expect, was a complete failure.

Surgery of the Soft Parts.—Too much emphasis cannot be placed on the importance of following the multiple-step method in dragging, or displacing forward, the skin and soft parts of side of face and neck. Formerly it was considered that this displacement must be accomplished in one or two operative procedures. Striking results have been accomplished in most difficult cases by repeated operative procedures (multiple-step method) in dragging the skin and tissues forward from the face or upward from the neck, and suturing with a safe amount of tension. One or two weeks are allowed to elapse, when, at another operation, it is found that the tissues are stretched and the tension has almost entirely disappeared. The skin and soft

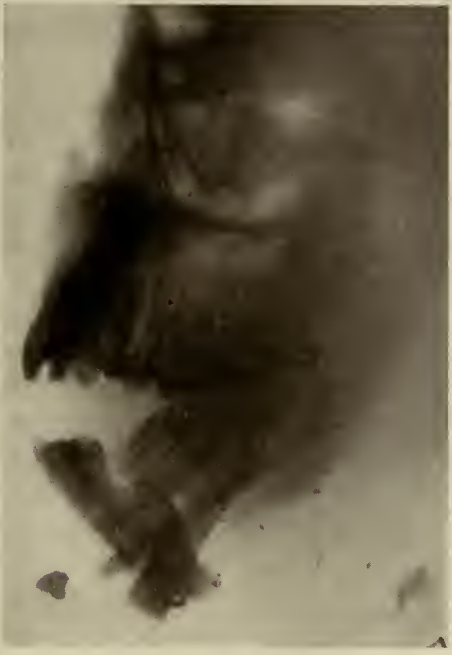

Fig. 140.—Case C. H. Lateral *x*-ray, taken seven weeks after operation, shows grafts in place. Union was firm.

parts are then again undermined, and still further displaced until the result desired is accomplished.

In cases where the loss of substance is so extensive that the multiple-step method of displacing neighboring skin and subcutaneous tissue from neck or face, is not adequate, the transplantation of these structures from some part of the anatomy has been resorted to, usually by the Italian plastic method. An ample amount of soft tissue can always be obtained from the top of the shoulder, from various regions of the arm, or by a two-step procedure, from abdomen to arm and from arm to the jaw. This latter method requires two operations and has no special advantage over the direct method from shoulder or arm to jaw. Ample skin and soft parts should always be obtained, as they are liable to shrink.

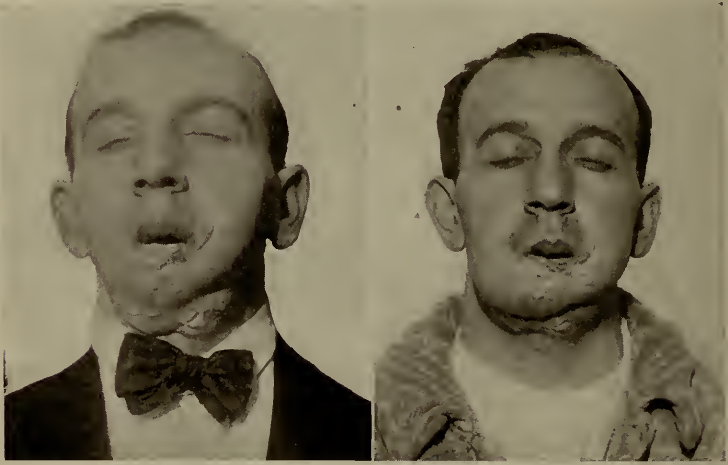

Fig. 141.—Case C. H. Before and after reconstruction of jaw by bone-grafts. Both bone-grafts restoring loss of bone on each side of the jaw have become firmly united and the jaw is very firm.

It is absolutely essential that the soft tissue work be satisfactorily done so as to afford ample soft tissues to cover the graft and allow the contour of the jaw and chin to be restored before the bone work is attempted. It is preferable, if possible, to approximate the skin-flaps of the neck and face and get union before resorting to a transplantation of skin and soft tissues from the neck and other parts. This is not, however, always possible, and the Carrel-Dakin or dichloramin-T method of wound sterilization should always be instituted in the presence of a granulating wound before the transplantation is attempted. This may be carried on in the interim during the operative procedures, *i. e.*, while the skin is being dragged inward and upward.

If the patient is brought to the surgeon early, within a few hours after injury, a thorough débridement should be done and, if possible, the soft parts should be primarily sutured. This may be impossible either on account of the extensive amount of tissue lost or owing to the length of time which has elapsed since injury, with the resultant infection of the tissues, in which cases the Carrel-Dakin method should be instituted immediately, and as soon as the wound is surgically clean the procedures on the soft parts should be begun.

Restoration of Bone.—The attempt to restore bone at the same time that the soft tissues are being supplied is never advisable; the results are not so trustworthy. A satisfactory graft cannot be obtained from the clavicle, as a rule, for the bone is not of the right shape and is not of large enough diameter. Furthermore, such a procedure is not so successful from the point of view of the growth of the bone-graft. Once the soft parts have been established, the graft material can be secured much more accurately and successfully.

The bone-graft restoration should never be attempted until the wound has been completely healed. If infection has existed around the ends of the jaw fragments at any time, a period of at least two months should elapse after complete healing before the bone-graft is inserted. Plastic soft tissue work should have as its object the satisfaction of two essential pregraft requirements, viz.: (1) to avoid or overcome the existence of skin scars adherent to bone in the immediate neighborhood of the proposed graft; (2) to furnish a well-nourished pliable soft tissue bed thick enough to receive the cosmetic molded graft.

Of all plastic work, the restoration of bone in the jaw demands the most exact and the most accurate cabinet-maker work of any, and, as a consequence, requires the use of electrically driven automatic machine tools or instruments.

Following the suggestions of Ollier, some have inserted the osteoperiosteal grafts, very thin and of no supportive value, in pseudo-arthrosis with or without loss of bone substance. They do not secure support, and thus do not overcome the deformity. In such cases they are absolutely dependent on the dentist's fixation which he produces by the interdental splints (metal splints upon the teeth) in those cases where teeth exist on both jaw fragments. In those cases where these conditions do not exist the interdental splint is of no service.

Again, the great disadvantage of this method has been especially emphasized in the author's experience in cases where the patient has been unable to tolerate the splint. In one case it was removed after twenty-four hours because of pressure-necrosis of the alveolar process. This case would have been a failure if osteoperiosteal grafts had been used. As it was, the strong inlay fixation graft held jaw fragments firmly and the result was most satisfactory. Osteoperiosteal grafts should be used only as supplements to a fixation graft.

When the requisite portion of the face is completely covered, healing of the soft parts must be awaited; if there has been no previous infection, the bone work may be done two or three weeks after healing of these tissues. With the blood-supply well established in the soft parts the bone-graft operation is performed. Owing to its high vascularity the face is one of the most favorable regions in the body.

In jaw work motor-driven tools and the mastery of their technic are more important than in any other class of work, and are practically indispensable.

Attempts to cut or mold bone of the lower jaw by ordinary surgical hand tools, such as the osteotome or chisel and mallet, is much more difficult than in any other similar work, and is practically impossible. First, on account of the hardness of the bone; second, on account of absence of anvil stability to the impact of chisel and mallet (chiefly due to the light weight of the inferior maxilla, its loose articulation, its irregular contour, and the difficulty, because of its location, of supporting it. Fragments of this bone always recede from even light blows of a chisel and mallet, and are, therefore, most difficult to cut in that way); and, third, on account of the complicated, irregular contour of the jaw and the difficulty of molding grafts by these means around curves, etc.

Gillies[1] speaks discouragingly of using "shaped block graft" and states how laboriously they are fashioned by such hand tools, and further says, "The method is very interesting and exceedingly good when successful. It is, however, much too difficult to perform, and requires an operation lasting sometimes over three hours." The writer would certainly agree that any bone-graft operation lasting three hours should not be done.

Gillies quotes another experience which still further emphasizes the disadvantage of continuing to persist in using the chisel and mallet in this work. He states that a "shaped graft, taken from a brittle tibia, broke twice before its shape was complete. In fitting in the remains into the recesses made for it in the fragments the fragments broke."

By the use of electrically driven automatic tools, such as both single and twin saws of different sizes, drills, burrs, and end mills of different sizes, the difficulties just enumerated are largely overcome in such operations. The elimination of shock has also been striking owing largely to the speed and accuracy with which the work is done, as well as their great efficacy in cutting through the hard bone, which otherwise would be done slowly and laboriously by heavy blows of the mallet on chisel or osteotome.

Again, an additional advantage of the rapidly revolving saw may be found in certain phenomena, strikingly illustrated in the World War, viz.: the laceration of non-vital tissues by means of a slowly traveling (spent) projectile causes such a bombardment of the central nervous system by a storm of different afferent noci impulses that the smitten soldier drops in his tracks in a profound state of shock. On the other hand, when these same tissues are severed by a projectile traveling at high velocity (providing the vital centers are uninjured) the soldier walks on with scarcely any evidence of vasomotor disturbance. In the latter contingency the nervous end-organs are severed by a cutting agent traveling at such speed that the nerve filaments are unable to deluge the central nervous system with a wave of afferent noci impulses, because they are incapable of taking up such stimuli as is produced by a severing agent traveling at such speed. An analogous set of circumstances likewise involves a severance of nerve-endings—by a slowly revolving saw or chisel, on the one hand, and a rapidly revolving saw on the other.

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[1] Plastic Surgery of Face, Oxford Medical Publication, 1920.

The author, of necessity, began his early bone-grafting operations with hand tools, and after he had developed his motor-driven instruments he found that shock had almost entirely disappeared in the course of operations of reasonable length. He is uncertain as to whether this absence of shock is to be attributed to Crile's theory of anoci-association or to a shortening of the time of operation brought about by motor-driven tools.

The author has frequently and purposely put in a graft whose diameters were larger than necessary, and after being fixed in place by the kangaroo ligatures, the external contour was molded in symmetry to the other side of the face by shaping it with the author's rotary motor-saw. The soft parts being temporarily approximated over it, as a framework, for the purpose of matching the contour of the other side of the face by trial. By this method a very satisfactory cosmetic effect has been frequently secured.

The Sources of Graft.—As a rule, the author prefers the tibia as source of the graft. Its bone-cells are more active osteogenetically than any other; moreover, its cortex is very dense and strong, and when molded into the shape of curves, always necessary in jaw work, it retains its characteristic strength. This is in special contrast to the bone of the rib (so frequently advocated as a graft for the jaw) which becomes very much weakened as soon as efforts are made to trim it or to mold it, thus losing its tubular strength. This is, of course, due to the extreme thinness of its cortex and the spongy nature of the interior of the rib.

The breadth of the tibia, though adequate in a large variety of cases for graft dimensions, is not large enough to allow the molding of grafts of wide curves, sometimes needed in cases of extensive destruction of the lower jaw. In the latter instance the author has resorted to the removal of the graft from the next most favorable bone, namely, the wing of the ilium, which is the broadest bone in the body. This bone is most favorable and will allow the molding of grafts of extreme curves.

The ilium is particularly accessible by the *Sprengel-Smith-Peterson* means of approach, the only difference being that the periosteum should *not* be removed with the muscle, as it is desirable to have it remain on the graft. Grafts U-shaped in general contour and large enough to restore a large portion of the jaw (from angle to angle) have been obtained from this bone.

The graft serves the following purposes: first, it furnishes an active bone-growing bridge of bone when accurately incorporated as an inlay in both fragments; second, it serves as an internal fixation splint; third, the marrow substance in the graft serves as a vascular conducting medium from the cancellous tissue of the one jaw fragment to that of the other—this is an important function in that the blood is brought from the healthy vascular cancellous bone back of the eburnated ends of the fragments to the region of bone proliferation. This function of the graft is often overlooked, and the technic is, therefore, not planned to bring it about. It is essential for all tissue proliferation that sufficient nourishment be brought to the part containing the cells which are to proliferate. Fourth, it serves as a bony framework for the overlying soft parts, and it is through the proper molding of the graft that the symmetry of the face may be restored.

Cosmetic results in the type of cases given above cannot be accomplished by means of the osteoperiosteal or the pedicled graft. The osteoperiosteal method is inadequate—the graft has no strength nor supplies mechanical support. Men have accepted and used such methods without any idea of shaping the symmetry of the face, apparently either because they do not wish to equip themselves adequately to do the work or they do not care to go to the trouble of perfecting themselves in the motor-mill technic. The comparison between doing this work in the latter way or by a chisel and mallet is about the same as riding in an automobile or walking.

The technic employed by some in the osteoperiosteal graft is as follows: the ends of the eburnated bone fragments are laid bare and the periosteum is pealed off. These tissues are often found devoid of adequate blood-supply, and furnish a very poor environment for the graft which is merely, as a rule, laid on the fragment ends spanning one-half on one end and one-half on the other. The cancellous tissues are not tapped, and the blood-supply is sure to be meager.

It is always necessary with such grafts to supply all support and fixation by interdental splints, and if they prove to be inadequate or intolerable to the patient, as in one of the author's cases, and their too early removal necessary, the result is seriously jeopardized. Whereas, if the graft is of the inlay type and well mortised it will furnish sufficient fixation, as it did in the author's case just mentioned. In fact, many cases with extensive loss of bone have been successfully operated without being able to employ the dental splint as a supplementary fixation.

Ideal Management of a Case with Loss of Bone Substance.—Prophylaxis is the ideal treatment of malposition of jaw fragments after loss of bone substance. Dental splints should be applied when possible by competent prosthetic dentists in cooperation with the surgeon at the earliest possible moment.

The functions of the interdental splint are:

(1) To prevent the occurrence of faulty alinement of the jaw fragments, and to correct already existing contractures and displacement of the jaw fragments (which swings over to one side when there is loss of bone, by the contraction of unopposed muscles and soft parts).

(2) To maintain the operative correction of alinement of the displaced fragments.

(3) To aid in the immobilization of the jaw fragments at the time of the bone-graft operation and during the convalescence.

It may occur that the splint cannot be tolerated by the patient, or that the extensive loss of teeth make it impossible to attach it. In this connection great emphasis should be laid on the importance of the accurate insertion and fixative effect of the graft, whereby, in such an event, it alone may be capable of furnishing adequate support and fixation of the jaw fragments. The removal of the dental splint two weeks before operation is advisable in order that a careful toilet of the mouth may be made and to permit movement of the fragments for the purpose of stirring up infection if a latent infection exists. If this should occur, a splint is reattached, and there is a thorough cleaning of the cavity, and the plastic bone operation is deferred for two or three months after complete healing.

If there is no infection, operation may be done in two weeks. Whatever displacement may occur can be readily corrected at the operation, as the time is not sufficient for a contracture.

Operation.—A general anesthetic is practically always necessary in such cases and should be given through nasal or pharyngeal tubes.

The skin incision should be so placed that the graft may be covered and embedded if possible in normal, vascular, blood-carrying tissues, through whose medium nourishment must be brought to the graft. Scar-tissue not only is devoid of blood-vessels, but it is liable to break down and slough. In cases with dense scar, with or without possibility of danger or exacerbation of latent infection, the bone-graft operation may best be done by two steps. The first operation in this case consists of removal of the scar-tissue, and its replacement by a plastic flap of healthy skin and subcutaneous parts sufficiently thick and of suitable character to receive the graft. If primary union occurs, the bone work usually may be done at the end of two weeks.

After the bone is laid bare every effort should be made at all times to avoid entering the oral cavity. Incision should be made low over the margin of the jaw to avoid this, as the mouth is full of bacteria. If the mucous membrane is punctured it must be sutured with great care, so as to avoid air being forced through during coughing or sneezing, and the infection be driven deeply into the wound with the air.

The ends of the jaw fragments are developed by sharp and blunt dissection. The author's twin-saw is then adjusted in accordance with the width of these fragments and cuts are made back from the fragment ends for a distance of as nearly 1½ inches as possible. The ends of the strip of bone between the saw cuts is then severed on each side by means of the small cross-cut saw, or with the end of the motor-drill. With a sharp, thin, narrow osteotome the strip of bone between the above-mentioned saw-cuts is then removed. If the bone is hard this may even be found difficult, and the small motor-saw or burr of Blake's end-mill may be used to complete the formation of the gutter.

By means of a flexible lead bar or probe, which is laid in the groove for the purpose of obtaining the exact contour of the proposed graft, the blades of the twin-saw, used for making the gutters in the jaw fragments, are then additionally separated a little less than twice the thickness of the blades, or twin-saw *B* (Fig. 124) is so adjusted that twin-saw *A* (Fig. 124), which has been used to form the gutter in the jaw fragments, will just engage in between the saw-cuts in *B* (Fig. 124), the object being to avoid the gutter made by the twin-saw unadjusted being twice the thickness of a saw-blade wider than the graft removed by the same twin-saw unchanged. By adjusting the twin-saw in this way, or by using two twin-saws, a much closer fit of the graft is secured.

The graft is obtained from the upper portion of the antero-internal surface of the tibia when possible, and the next best source is the wing of the ilium. This is the broadest portion of the bone, as well as having a thinner cortex, which is more in keeping with the thickness of the bone in the jaw. The flexible probe or lead bar is laid upon the flat surface of the tibia and with the scalpel, using the twin-saw as a guide, the proposed graft is carefully mapped out in the periosteum.

The graft is then removed by means of the twin-saw, while a drip of saline solution is furnished to the saw. The motor-saw should be allowed to travel its whole width into the marrow cavity before it is pushed along the length of the bone, so that contact with the marrow may furnish a lubrication to the saw. The drill-holes for the kangaroo tendon (as shown in Fig. 122) are put in after forming the gutter; the kangaroo tendon is already in the drill-holes before the graft is obtained. When the graft is removed the kangaroo tendon is lifted up by some long instrument and the graft is slipped through under the kangaroo tendon and the tendon is then pulled down over the surface of the graft. The graft is then forced into place by means of an Ochsner clamp; the kangaroo tendon is tied; the second half-knot is locked by tying No. 1 chromic catgut about it.

The deeper structures are pulled over the graft by a curved needle with No. 1 chromic catgut. The skin is closed by small sutures of fine silk. A large dressing is applied, with a bandage over the top of the head.

The patient is fed by a tube immediately after the operation.

The following are illustrative cases:

Case S. I. illustrates those in which massive grafts are absolutely necessary to bring about cosmetic results. This young man, eighteen years of age, presented an uneventful history. He had always had a markedly receding chin, without known cause. This was especially annoying to him in that his father had an unusually prominent lower jaw. He felt sure that this defect in his physiognomy would lead individuals in his future business career to distrust his ability to make a decision and stick to it. His family felt that it had become essentially a fixed idea with him, and thought if the chin could be safely lengthened by a surgical procedure it should be done. Therefore, this young man was operated on at the New York Post-Graduate Hospital on July 20, 1922, and a graft from the upper third of the right tibia, including the crest and about $1\frac{3}{4}$ inches long, $\frac{3}{4}$ inch wide, and $\frac{1}{2}$ inch thick, was placed on the anterior prominence of the lower jaw as shown in Figs. 102–116.

The following 2 cases are illustrative of those difficult cases in which dental splints, osteoperiosteal and pedicle bone-grafts are not possible of application. It illustrates further the mechanical, immobilizing, and cosmetic possibilities of the inlay graft when employed in the most difficult cases of loss of substance of the lower jaw, and inserted according to the author's inlay method and by means of automatic electrically driven instruments.

C. H., age thirty-two years; Russian; male (Figs. 138–142).

History.—Two and a half years ago, while in Russia, patient was shot by bandits. He sustained an injury to the lower jaw. The shrapnel, the causative factor, destroyed the greater part of both rami of the lower jaw. The submental and sublingual tissues were markedly lacerated. The wound was infected and drained for over four months.

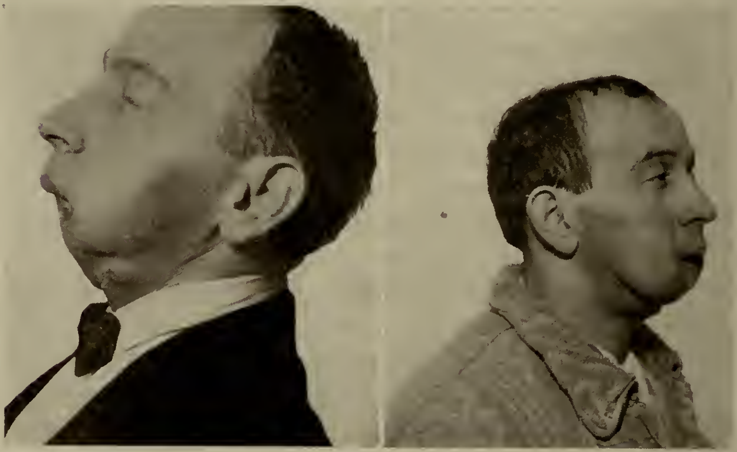

Fig. 142.—Case C. H. Before and after restoration of both sides of jaw by bone-grafts. An operation similar to that done in Case S. I. is to be done later in this case for cosmetic purposes only.

After the wound had granulated in, an operation on the soft tissues was performed in a Moscow hospital. This operation, according to the story of the patient, improved his looks markedly. No improvement in function of the lower jaw followed, however. No attempt was made to improve the bony framework.

Now, almost two years after the plastic operation, the patient comes to this country specifically for operation on the lower jaw for functional result primarily, and cosmetic at the same time if possible.

The patient, on examination, presents an irregular scar in submental and thyroid regions. The mentum of the lower jaw is retracted. There is practically no control of the remains of the lower jaw.

When questioned, the patient complains of difficulty in breathing in all positions, especially when on his back. There is also difficulty in swallowing even fluid, and that primarily was the only type of food he could take. His speech was very poor.

On examination, it was found that portions of both rami were absent. An island of mentum with 3 teeth was intact, and could be drawn forward into practically normal position, in reference to the upper jaw alinement. The mandibular joints were intact with fragments of rami just below the angles. The gap on the left side was the greater of the two, measuring about 1½ inches. The right side gap measured about 1 inch.

An open operation was performed, inlay bone-grafts, obtained from the left tibia, were fixed in position with kangaroo tendon sutures. The island of jaw, mentum with 3 teeth, was thick, rigidly fixed in proper position. At the same time pressure on larynx was relieved, the base of the tongue was pulled forward. It was impossible to use any interdental splint because of lack of teeth in the posterior fragments.

Three days after operation patient noticed that breathing and swallowing were much easier than heretofore. Temperature came down to normal and has remained so since. Two weeks after operation the wound was healed by primary union. No dressing or external means of immobilization was used. The patient at this time is very happy, feeling very well, relieved of all symptoms as to difficulty in breathing and swallowing. Breathing is normal in all positions, speech is much clearer. Soft food was taken soon after operation without difficulty. The cosmetic result is good.

CLINIC OF DR. WILLIAM A. DOWNES

St. Luke's Hospital

HOUR-GLASS CONTRACTION OF THE STOMACH

Summary: History of Case with *x*-Ray Findings. Usual Pathology Found in Hour-glass Contraction Due to Ulcer. Reasons for Believing Gastro-gastrostomy Combined with Pyloroplasty Best Operation for Present Case. Discussion of Various Methods of Operating for this Condition Based on 22 Personal Cases.

This patient, Mrs. S. C., aged fifty-three, was admitted to the Medical Service ten days ago, giving a history of vomiting and epigastric pain. These symptoms, intermittent for the last month, had become almost constant during the past week. Vomits immediately after taking food and for several days has been unable to retain water. Loss of weight (out of proportion to the loss of strength) has been rapid. Weight at this time 75 pounds. Patient states that about three years ago she was subject to attacks of upper abdominal pain which came on about one-half hour after eating and were relieved by vomiting. These attacks disappeared in a few months without any special form of treatment, and she remained fairly well up to the present illness. Has never vomited blood. As in all dehydrated patients, she shows marked concentration of the blood—the red blood-cell count being 5,100,000 and the hemoglobin 109 per cent. Wassermann reaction negative. Blood-pressure 118/78. Urea-nitrogen 23.8 millimeters per 100 c.c. of blood. The immediate indications to be met in this case were to control the vomiting and treat the dehydration; accordingly, large quantities of fluid were given by hypodermoclysis and by the rectum. All food and fluids by mouth were stopped and she was given daily lavage. Three days after admission fluoroscopic examination was made and films taken of the gastro-intestinal tract. A typical hour-glass contraction of the stomach—the result of a penetrating ulcer of the lesser curvature—was found (Fig. 143), the constriction being at about the middle of the stomach. The channel connecting the pouches is very narrow, so that at the end of six hours—as you will see by the films—there is still retention in the upper pouch. You will also notice in this film that a large amount of the barium mixture remains in the lower pouch, indicating stenosis at the plyorus (Fig. 144). At the end of seventy-two hours there was still retention in the distal pouch. Delay in emptying time is not always caused by an actual stenosis at the pylorus, but may result from interference with the motility of the stomach; in any event, it is a factor that must be given serious consideration before coming to a decision as to the best operative procedure to adopt in a given case. We have, therefore, to deal with an emaciated dehydrated

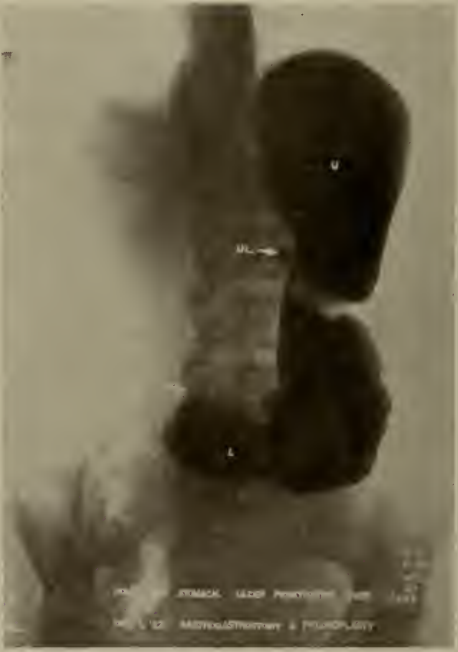

Fig. 143.—Five minutes after bismuth meal.

patient weighing only 75 pounds suffering from hour-glass contraction of the stomach with retention in both the cardiac and pyloric pouches. It might be well at this point to refer briefly to the pathology as usually found in these cases. To begin with, for a considerable period of time, years perhaps, before coming under observation there is the history of an active ulcer which after a longer or shorter period of time slowly penetrates the stomach wall and becomes adherent to the under surface of the liver or the pancreas. The great majority of these ulcers are situated on the lesser curvature or posterior wall. The x-ray findings in penetrating ulcers are characteristic. Apparently after the ulcer perforates there is often a tendency for it to heal spontaneously, and it is in this effort at healing that the contraction takes place. The contraction is always in the transverse diameter of the stomach and at the expense of the greater curvature. The symptoms of ulcer are replaced by those due to obstruction, and at operation extensive adhesions and scar tissue may be all that is left to show of the ulcer.

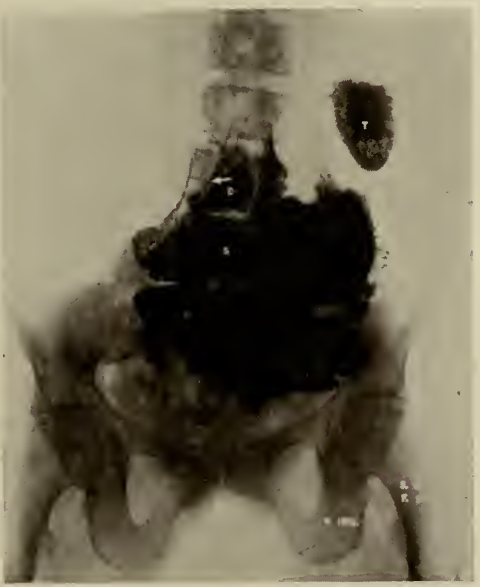

Fig. 144.—Six hours after meal. Retention in both pouches.

In coming to a decision as to the type of operation best suited for the case before us two important factors must be taken into consideration. The first is that the patient is in very poor condition, and for this reason the simplest and quickest operation that will meet the indications must be performed. The second fact to be considered is that there is an obstruction at the pylorus as well as at the point of constriction, therefore both pouches must be drained in order to obtain a satisfactory result. After a study of the findings and a careful examination of the films I have about reached the conclusion that gastrogastrostomy combined with pyloroplasty will meet the indications and should probably be the procedure of choice. This decision is arrived at because the pouches are large, and, if the *x*-ray interpretation is correct, lie close together; furthermore, the operation can be done in the shortest possible time. The only other procedure that will drain both pouches is a double gastro-enterostomy, and I am sure that technically it would prove much more difficult than the operation I have in mind.

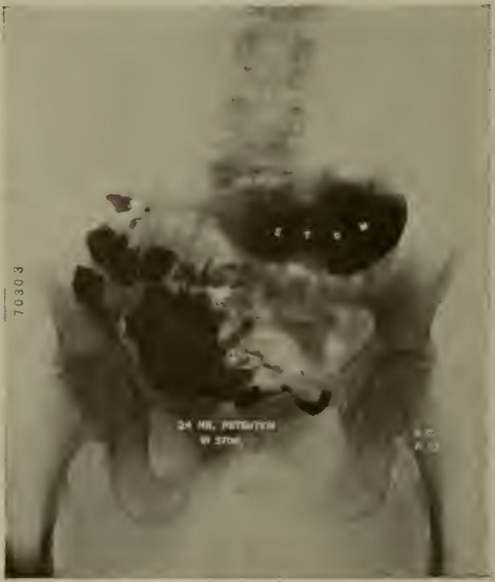

Fig. 145.—Retention in distal pouch twenty-four hours after meal.

Midgastric resection would probably prove too formidable an operation on account of adhesions to the liver and, besides, a pyloroplasty would have to be added. As a rule I do not favor the idea of planning intra-abdominal operations before the lesion is exposed, as the judgment of the operator may unconsciously be prejudiced thereby; however, when the patient is in such poor condition as this one is it may be of help to have at least a "working plan" to go by. We now proceed with the operation, and you will notice as the abdominal wall is retracted that the midportion of the stomach is contracted and drawn up under the left lobe of the liver. There is a hard firm mass of adhesions extending over an area of from 2 to 3 inches. The entire circumference of the stomach wall is involved in this cicatricial mass and there is a narrow channel—say 2 inches in length—connecting the two pouches. You will further notice that the pouches are freely movable, and that the walls of the stomach on either side of the constriction are free from induration. It will be a very easy matter to anastomose these pouches; whereas resection of the constricted portion of the stomach including this cicatricial mass would be an operation of considerable magnitude. We now examine the pylorus and find firm adhesions to the gall-bladder and under surface of the liver. There is no evidence of ulcer at this point, but the pyloric ring is hard and narrow, admitting the tip of the finger with difficulty. The duodenum is unusually mobile. A pyloroplasty is definitely indicated.

As the first step in the gastrogastrostomy we place a loop suture at the most dependent points of the adjoining surfaces of the proximal and distal pouches. You will observe that these sutures are placed well down in the incisura and catch the stomach at the margin of the greater curvature. Two similar sutures are placed about 3½ inches higher up, that is, almost at the apex of the incisura. As traction is made on these sutures the pouches become approximated. Their peritoneal surfaces are now united by a continuous suture of silk for a distance of 3 inches. A second row of fine chromic catgut is placed posteriorly. The pouches are now opened for a distance of 2½ inches by parallel incisions placed about $\frac{1}{4}$ inch to either side of the suture line. You observe that we are not using clamps in this operation. The bleeding points, which are very few, are quickly picked up, and by the use of the suction apparatus there is little or no soiling from the stomach. The posterior edges of the cut surfaces are now united by a through-and-through continuous suture of chromic catgut which is continued as a self-inverting stitch all the way around in front to the point of beginning, thus completing the stoma. The original silk suture is now continued along the front of the wound to the starting-point. Several interrupted sutures are taken to reinforce the line of continuous suture (Figs. 146–150). Having completed the gastrogastrostomy, we turn our attention to the pylorus. A few months ago I had the privilege of seeing Dr. Finney perform a pyloroplasty according to his method, and was so much impressed that I began using the method in every suitable case. Heretofore in doing the operation I had attempted to modify it somewhat, and was not always pleased with the result. Now, however,

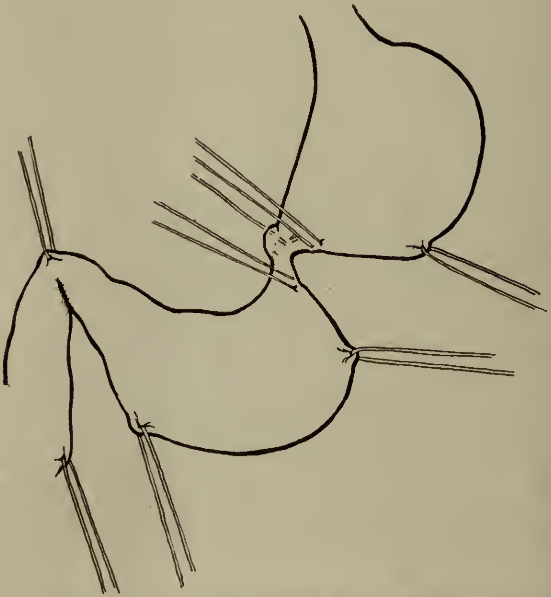

Fig. 146.—Showing traction sutures in place.

since following Dr. Finney's technic, I have found the operation much easier to do and the results perfectly satisfactory. This is an ideal case for the Finney operation. The first step is to free the pyloric end of the stomach and the upper portion of the duodenum of all adhesions. You will notice that we are able to mobilize these structures freely. A guy suture is now taken at the highest point in the pylorus, and similar sutures are placed at opposite points on the stomach and duodenum, about $2\frac{1}{2}$ inches below. By making traction on these sutures—the one above and two below—the adjoining surfaces of the stomach and duodenum are brought together, and while held taut their peritoneal surfaces are united by a continuous suture of silk, keeping as far posterior as possible. We now place the mattress-sutures which are to be used later in closing the anterior part of the incision. These sutures extend well out on the walls of the stomach and duodenum, are cut long, the ends caught with hemostats, and left untied for the present. Eight of these sutures will be enough in this case. They are now separated

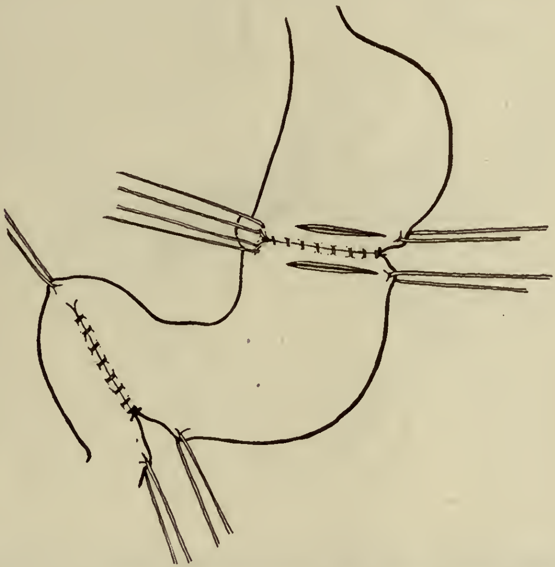

Fig. 147.—Peritoneal surfaces united. Incisions made in pouches.

into two parts—four being drawn up above the upper guy stitch and four downward below the lower stitches. An inverted U-shaped incision is now made in the exposed area, starting on the stomach side about $\frac{1}{4}$ inch from the posterior continuous suture (inside the row of mattress-sutures), and carried around through the pyloric ring and down on the duodenum for a similar distance. Each limb of this incision should be about 2 inches in length. The posterior cut surfaces of stomach and duodenum are now united by a continuous through-and-through suture of chromic gut, beginning at the upper angle and continued down and well around the lower angle. We now release the mattress-sutures, and as they are drawn taut and tied observe how nicely the edges invert. A running suture is taken to reinforce the mattress-sutures (Figs. 146–150). We are now ready to close the abdomen. The operation has taken something less than an hour, and there has been practically no blood lost. The anesthetist states that the patient's condition is very sat-

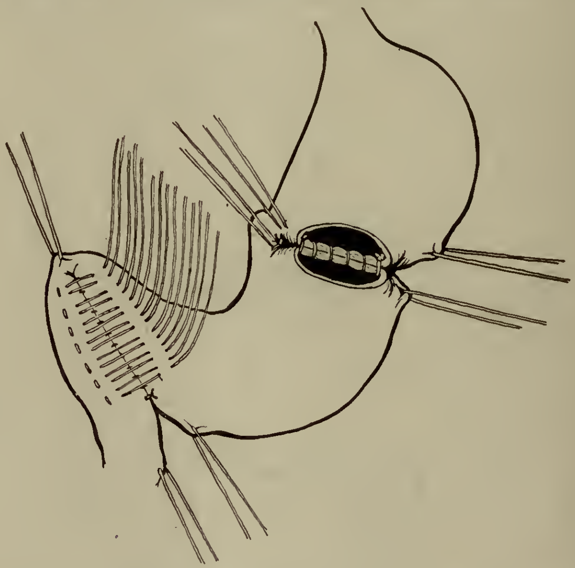

Fig. 148.—Posterior edges of incisions in pouches united. Mattress-stitches placed at pylorus.

isfactory. As soon as she is returned to the ward she will be given 500 c.c. of a 5 per cent. glucose solution under the skin, and in about three hours the Murphy drip will be started. In twelve hours small amounts of water containing bicarbonate of soda will be given by mouth, and fluids gradually increased as indicated.

Discussion.—We do not see as many cases of hour-glass contraction of the stomach as we did some eight or ten years ago, due no doubt to the fact that since the advent of the *x*-ray the diagnosis of ulcer is made, and treatment begun much earlier. The incidence has been reported as from 3 to 10 per cent. in different clinics. The former figure more likely represents the occurrence of the condition at the present time. Years ago there was considerable discussion as to whether hour-glass stomach was not of congenital origin, however, it is now generally agreed that practically all cases result from ulcer of the body

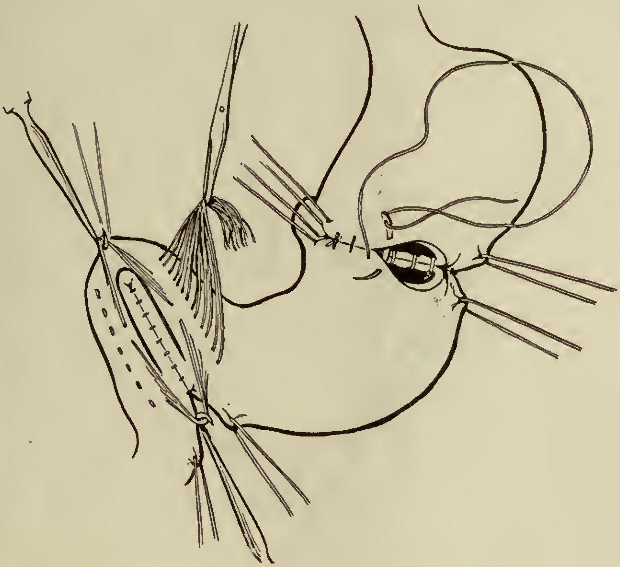

Fig. 149.—Closure of anterior portion of stoma between pouches. Mattress-sutures separated in two portions. Outline of U-shaped incision at pylorus.

of the stomach. The condition occurs in women much more frequently than in men, and there is always a history of long-standing stomach trouble. Frequently all active symptoms have subsided and there may be a considerable period of comfort with improvement in general health before the symptoms due to obstruction arise. The outstanding feature in most cases is the extreme loss of weight. The diagnosis at the present time is made entirely by the x-ray, where as formerly various methods of distending the pouches and lavage with careful examination of the returns were the only means at our disposal. It can readily be seen that the diagnosis was not often made before the x-ray came into general use. The treatment of hour-glass contraction of the stomach (and we are now discussing the cases in which the condition is presumably benign) may be divided into two periods—the early or preventive period, in which the ulcer is removed either by excision or the cautery, thereby avoiding the

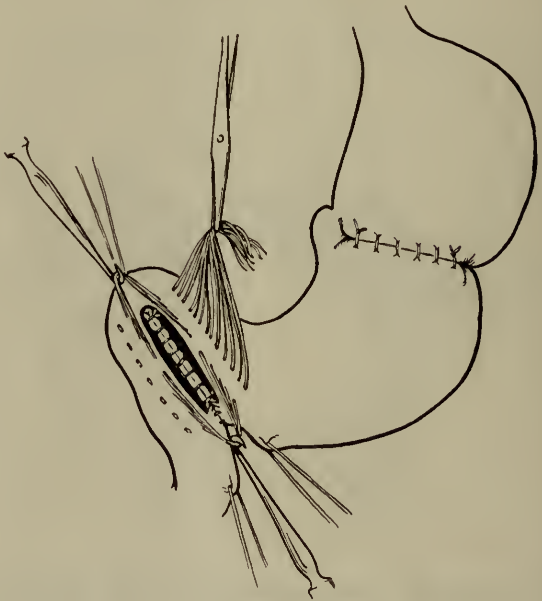

Fig. 150.—Gastrogastrostomy completed. Posterior cut edge of stomach and duodenum united.

formation of scar tissue with its resulting stricture, and the late period, in which the most important indication is to relieve the symptoms arising from obstruction. If the ulcer or the cicatrix of a healed ulcer can be excised at the same time, so much the better. Resection of the body of the stomach—the so-called sleeve resection—is the ideal operation for hour-glass constriction, as it meets all the indications. It is applicable to the cases with a patent pylorus in which the adhesions are not too extensive and the pouches fairly equal in size. As it may be a long operation it should not be done if the patient is in poor condition.

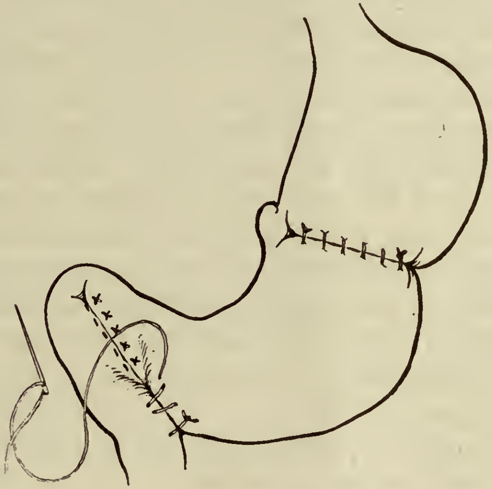

Fig. 151.—Mattress-sutures tied. Reinforcing suture of silk.

We have performed this operation six times, with one death. The death occurred from pneumonia on the sixth day in a patient in very poor condition upon whom a less severe operation should have been performed. This was the only death in our series. The clinical results from this operation have been extremely satisfactory. One of the patients remains perfectly well after nine years. In no case has there been a tendency for the contraction to reform. Judd has recently reported excellent results from this operation at the Mayo Clinic. In cases in which the ulcer remains active where there is a small pyloric pouch partial gastrectomy according to the Polya method may be adopted. None of our cases were operated by this method. Gastroplasty was employed four times. In 2 of the cases an ulcer was excised, and in 1 it was cauterized. Gastro-enterostomy was added in one case. The results from this operation have not been satisfactory. Two have returned with symptoms requiring a second operation. I feel sure that gastro-enterostomy should be added in every case in which an ulcer is excised for the lesser curvature. Gastro-enterostomy alone was the procedure adopted in 7 cases. This operation was employed in the cases in which the constriction extended over a wide area, resulting in considerable separation of the pouches. The results were very good in all except one case. This patient returned in two years complaining of pain and discomfort. *x*-Ray examination showed marked retention in the distal pouch. Pyloroplasty was then added, with complete relief. One of these patients died of aortitis in this hospital one and a half years after operation. In performing gastro-enterostomy it is important to make certain that the anastomosis is made to the proximal pouch. At least 6 deaths have been reported in which it was found that the mistake had been made of uniting the intestine to the pyloric pouch, that is, distal to the obstruction. I have had no experience with double gastro-enterostomy. In a case in which the pouches are large enough and sufficiently mobile to permit of this operation, it seems to me that gastrogastrostomy is preferable, adding pyloroplasty if indicated.

Gastrogastrostomy was performed in 5 cases, with excellent results. My first case of hour-glass constriction, operated by this method over fourteen years ago, remains well. This operation is suitable for all cases in which the pouches are fairly large and can be easily approximated, and is especially indicated if the patient is in poor condition and where haste is an important factor. Pyloroplasty should be added if there is retention in the pyloric pouch.

Briefly, from my experience, I would say that in properly selected cases midgastric or sleeve resection is the operation of choice for the treatment of hour-glass constriction, for the reasons that it removes the ulcer as well as all cicatricial tissue, and restores the stomach to a more nearly normal condition than any other operation. The method has definite limitations, however, which should be remembered. For instance, it should not be used if the patient is a poor risk, nor should it be attempted if there is wide separation of the pouches or marked inequality in their size. Gastrogastrostomy and gastro-enterostomy meet the immediate indications, that is, overcome the obstruction, but have the disadvantage of not removing the ulcer or cicatricial tissue; however, this is not always necessary and may even be unwise in many cases. The former is the simplest operation that can be used, and should be adopted in all cases in which time is an important element, provided the arrangement of the pouches will permit. In the cases in which the channel is long, separating the pouches by considerable distance, gastro-enterostomy is the operation of choice. If there is retention in the pyloric pouch pyloroplasty should be added to either gastrogastrostomy or gastro-enterostomy.

Eighteen out of the 22 patients included in this report have been followed for periods of from eight months to fourteen years.

Note.—Mrs. S. C. made an uneventful recovery and was discharged to a convalescent home on the twenty-eighth day.

CLINIC OF DR. R. W. BOLLING

St. Luke's Hospital[1]

COMPLETE EPIPHYSEAL FRACTURE OF THE HIP

The first patient whom I wish to present to you today is a boy of fifteen, who was admitted to St. Luke's Hospital two days ago with the following history: About five months ago he began to have pain in his left hip severe enough to cause him to limp. This pain resulted in his seeking medical advice, and for two months he was treated by massage. No roentgenogram was taken. The pain disappeared and he was all right until three weeks ago, when it recurred and became progressively worse. The day before admission he was able to walk, though with difficulty. The following day, however, he could not walk at all, and was brought to the hospital in a car. The only history of trauma which I have been able to elicit is that on several occasions one or another of his comrades struck him in the region of the hip with his fist. The family and personal history is entirely negative save for the fact that seven years ago he had "infantile paralysis" and two years ago an abscess in the ear.

The physical examination shows a moderately well-developed and nourished lad apparently sound in every way save for the condition in his hip. The result of the various laboratory tests has no bearing on the condition.

When we examine the left hip we find the joint practically fixed by muscular spasm, the thigh adducted, rotated out, and an actual shortening of about 2 cm. The roentgenograms show a complete epiphyseal fracture at the hip (Fig. 152).

The rational method of treatment for this condition is reduction of the deformity by the abduction method and fixation

[1] Service of Dr. William A. Downes.

by means of a plaster spica from the nipple to the toes. Under ether anesthesia the pelvis is fixed by wide abduction of the sound limb, and then the limb on the injured side is gradually abducted as widely as possible. As this maneuver is carried out you will note that before the widest possible range is obtained there is considerable resistance, which I attribute to the fact that the abductor muscles have become somewhat contracted. I shall not now attempt to gain wider abduction, but if the roentgenogram does not show proper reduction, I shall make another attempt.

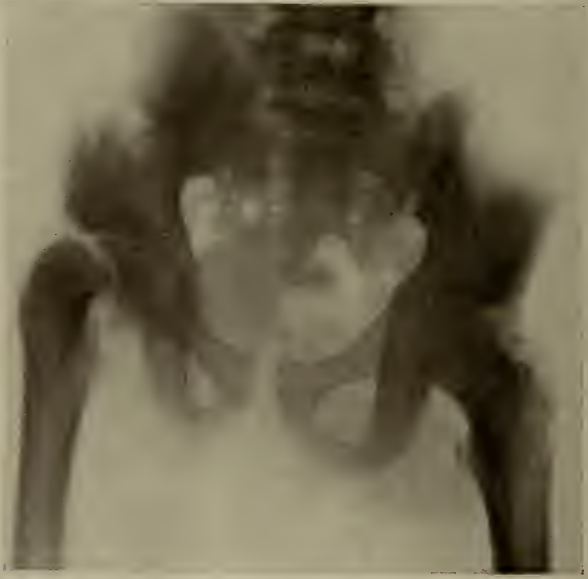

Fig. 152.—Case I. Complete epiphyseal fracture of the hip.

The patient, as you see, is on the Hawley table, and after having gained by manual manipulation the position which I wish to maintain, I fix the limbs in this position, the thigh extended, widely abducted and rotated inward, and proceed to the application of the plaster spica extending from the nipple line to the toes.

I should like to emphasize the point that I find the fracture table of great assistance in maintaining the patient in the proper position for the application of the spica, but that the actual reduction of deformity should be done by hand, with the aid of an assistant, who manipulates the sound limb.

Having obtained satisfactory reduction, I will maintain fixation for about three months. Following this massage and exercises will be instituted, and the patient will be required to wear a Thomas splint for several months longer.

Doctor Royal Whitman[1] has recently directed attention to the incomplete epiphyseal fractures at the hip in adolescents. In view of the history of this patient it seems to me reasonable to assume that following some trauma which he cannot now remember there was an incomplete fracture at the epiphyseal junction of the hip, that for some reason the process of repair checked the increase of deformity for a time, and that following some further slight unnoticed trauma there was a further gradual displacement of the head upon the neck during the three weeks immediately prior to his admission to the hospital, and that his

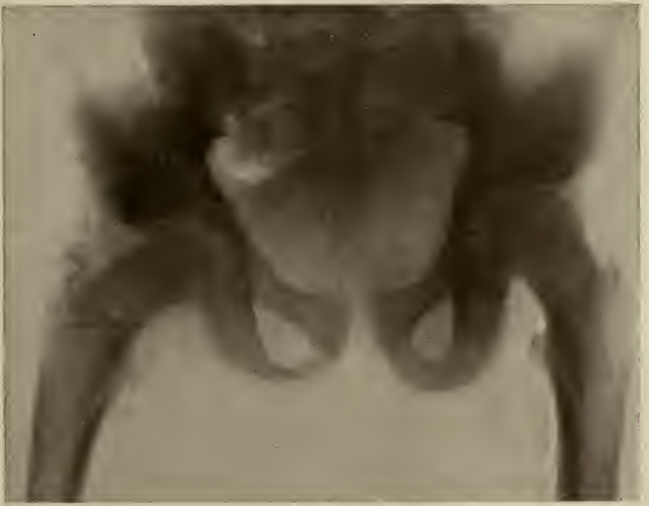

Fig. 153.—Case I. Complete epiphyseal fracture of the hip after reduction.

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[1] Annals of Surgery, November, 1922, vol. lxxvi, No. 5, p. 624.

admission to the hospital was determined by the complete giving way of the weakened epiphyseal junction. Had a roentgenogram been made during the earlier stages it would doubtless have revealed the condition and indicated the treatment.

Note.—Figure 153 is a roentgenogram made the day following and shows a satisfactory reduction of the deformity.

PARTIAL DISLOCATION BACKWARD OF THE LOWER EPIPHYSIS OF THE FEMUR

In connection with the last patient I wish to show you this little girl of seven, who was admitted to St. Luke's Hospital on July 3, 1922. Three weeks before admission a large sign was blown against the patient's left side. Immediately following the injury the child was able to walk a short distance, though suffering great pain in the left knee. For three weeks she received medical attention at home, being confined to bed during that period.

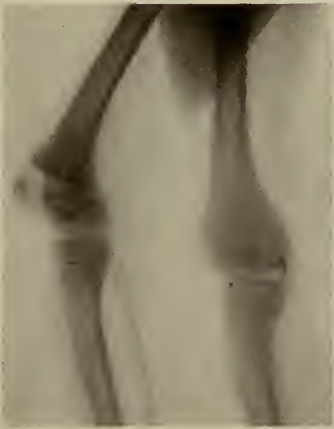

Fig. 154.—Case II. Partial dislocation of the lower femoral epiphysis three weeks after injury.

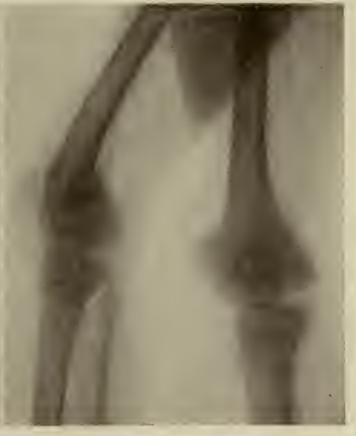

Fig. 155.—Case II. Partial dislocation of the lower femoral epiphysis twelve weeks after injury.

On admission to the hospital there was diffuse swelling of the left knee, and on the outer aspect of the joint there was evidence of old ecchymosis and a healed abrasion. There was a small amount of fluid in the joint. Extension was limited. A roentgenogram made at this time revealed a partial dislocation backward of the lower epiphysis of the femur (Fig. 154).

After careful consideration it was decided not to attempt to reduce the dislocation, in view of the length of time following the injury. After a few days in bed at the hospital it was found that the knee could be almost completely extended, and a light circular plaster case, including the knee, was applied. This remained on for two weeks, when it was removed. Following the removal of the case massage was instituted. Two weeks later a marked synovitis of the left knee developed, and it turned out that the young lady had been getting up out of bed and walking whenever opportunity presented. The only treatment of this condition was a cotton dressing firmly bandaged and the insuring of the patient's remaining in bed. The fluid in the joint disappeared in about two weeks, and two weeks later the child was allowed to walk, and was discharged from the hospital nine weeks after admission. A roentgenogram made at this time (Fig. 155) shows the improvement in position.

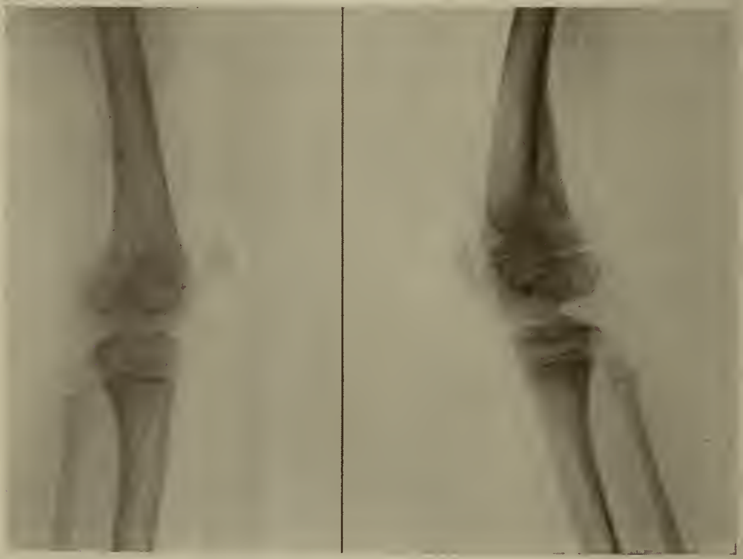

Fig. 156.—Case II. Partial dislocation of the lower femoral epiphysis seven months after injury, with the normal knee for comparison.

It is now six months since her injury, and she has perfect function. There is no deformity, no shortening can be made out, and the roentgenogram (Fig. 156) shows that the displacement has disappeared. It is, of course, too early to state that there will be no interference with growth, but certainly there is no evidence of such interference at present and no suggestion of premature ossification.

This patient illustrates the wisdom of conservatism in the treatment of certain cases of partial dislocation of an epiphysis seen for the first time several weeks after the injury, and where an open operation is the alternative. I believe this to be notably true in the case of the lower radial and lower femoral epiphyses. In recent cases, of course, every effort should be made to reduce the deformity. Certainly in this particular instance no more satisfactory result could have been obtained by any method of treatment.

SUBASTRAGALOID DISLOCATION OF THE FOOT BACKWARD AND DOWNWARD

This patient is shown to you as an end-result on account of the rarity of the condition and the practically perfect functional result following a very severe injury.

C. S. K., Hospital No. 18,212, age twenty-seven, was admitted to St. Luke's Hospital on October 19, 1919. On the day before admission the patient was riding in an auto and in some way his right foot was caught between the side of the rapidly moving car and a tree. The exact mechanism of the injury could not be made out. I saw him about thirty-six hours after he had been injured.

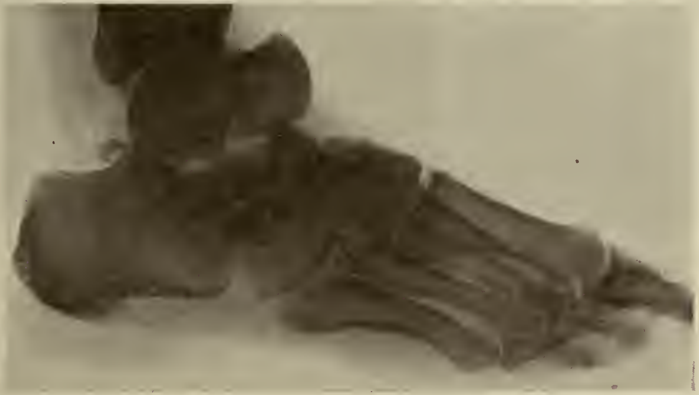

Fig. 157.—Case III. Subastragaloid dislocation of the foot, backward and downward.

The foot was enormously swollen, ecchymotic, and covered with blebs. The skin on the dorsum was very tense, and on account of the great swelling I was unable to make a diagnosis of the exact character of the injury.

The roentgenogram (Fig. 157) revealed a subastragaloid dislocation of the foot backward and downward, with a fracture of the anterior portion of the calcaneum and of the posterior process of the astragalus.

Under ether anesthesia a vertical incision was made over the center of the dorsum of the foot, the anterior portion of the projecting astragalus exposed, together with the posterior portion of the scaphoid. The soft parts were retracted and by means of a thin flat periosteotome, used as a lever, the dislocation was reduced (Fig. 158). The reduction was not quite complete, due apparently to the irregularity of the upper surface of the anterior portion of the fractured calcaneum. The attempt to secure perfect reduction was not persisted in on account of the very extensive injury to the soft parts. The subcutaneous tissues were sutured, but on account of the great swelling it was impossible to secure accurate apposition of the skin.

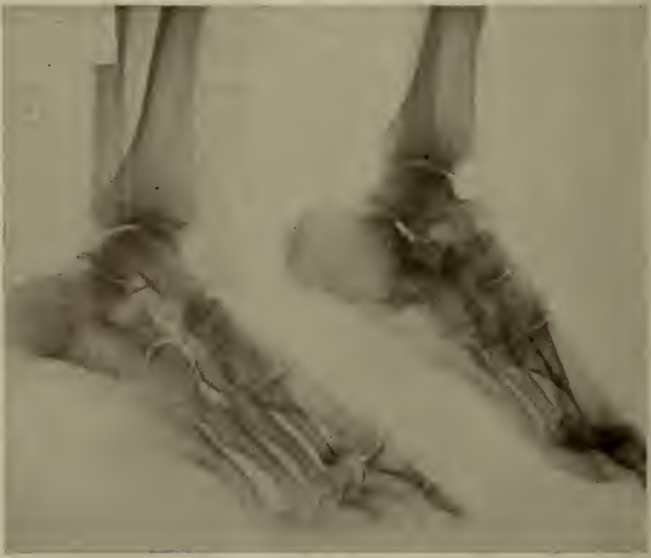

Fig. 158.—Case III. Subastragaloid dislocation of the foot eighteen months after reduction.

The foot was placed in a posterior molded splint at right angles to the leg. There was some superficial necrosis of the skin, but the wound healed without apparent infection. Ten days after operation a circular plaster case was applied and immobilization maintained for one month longer.

Following the removal of the case baking and massage were instituted, and the patient was discharged eight weeks after admission, walking with a crutch. His convalescence was slow, but his improvement was progressive, and within four months he was back at work, not at his original job as a furniture mover, but in some clerical capacity. He has continued to improve until now I am scarcely able to make out any disability, and the patient tells me he thinks his foot is almost as good as it ever was. Figure 159 shows the condition of the foot at the present time.

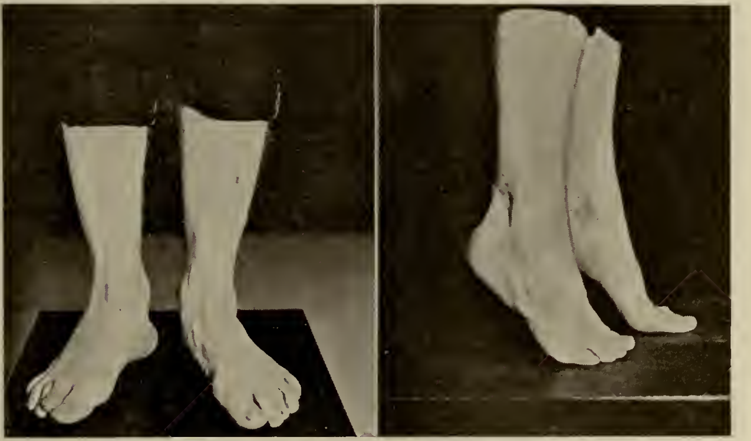

Fig. 159.—Case III. End-result following open reduction of subastragaloid dislocation of the foot.

There are four varieties of subastragaloid dislocation of the foot: That in which the calcaneum and scaphoid are displaced inward, that in which they are displaced outward, and the two much rarer forms, in which they are displaced directly forward or backward and downward.

GUNSHOT WOUND OF FINGER

This patient is shown to illustrate the fact that conservative measures should always be attempted in wounds of the fingers before advising amputation.

H. O., a lad of seventeen, was admitted to St. Luke's Hospital on March 16, 1922. On the day before admission the patient was wounded by the accidental discharge of a 38-caliber revolver which he was handling. The bullet entered on the inner palmar aspect of the proximal phalanx of the third finger of the left hand, and traversed the phalanx, the wound of exit being on the outer dorsal aspect. He was advised by his local physician to have his finger amputated, but he refused this advice and came into the hospital.

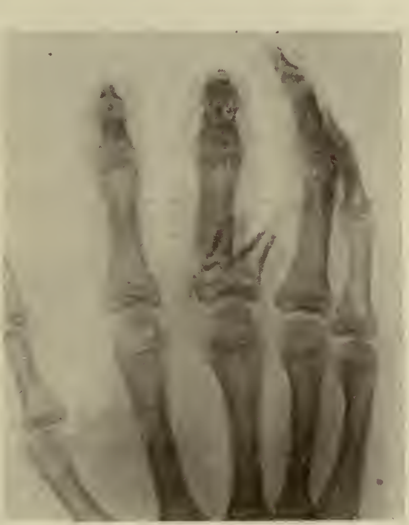

Fig. 160.—Case IV. Gunshot wound of finger.

The wound of entry was burned and stained by powder. A roentgenogram (Fig. 160) showed a comminuted fracture of the proximal phalanx, with much displacement. Under ether

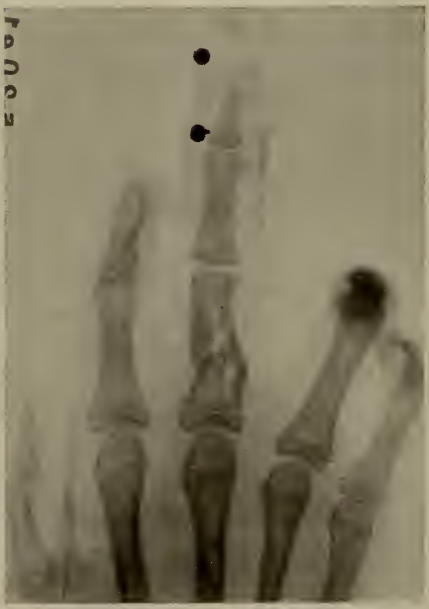

Fig. 161.—Case IV. Gunshot wound of finger after reduction.

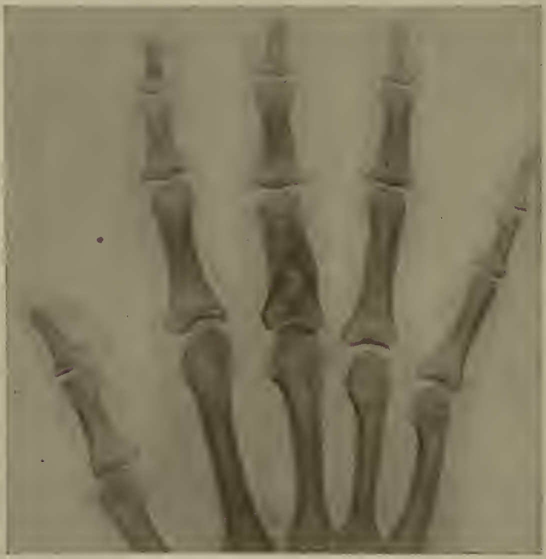

Fig. 162.—Case IV. Gunshot wound of finger nine months after injury.

anesthesia both wounds were carefully débrided and the fracture reduced after removal of two small loose fragments of bone, no

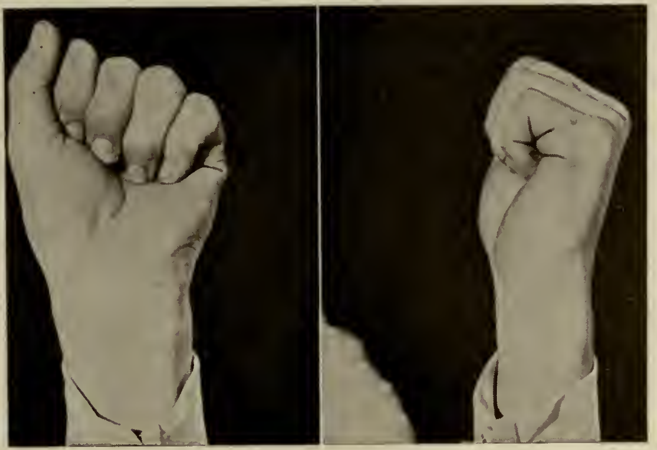

Fig 163.—Case IV. End-results of treatment of gunshot wound of finger.

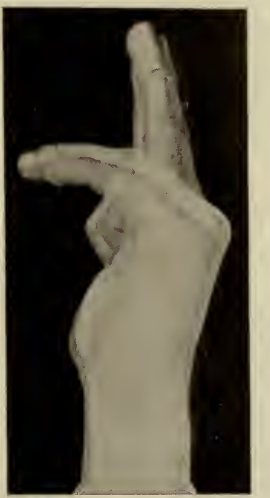

Fig. 164.—Case IV. End-result of treatment of gunshot wound of finger.

attempt being made to suture wounds. Reduction was maintained by elastic traction obtained through a dorsal wooden splint extending from the wrist, where it was fixed with adhesive plaster, and projecting beyond the tip of the injured finger. A rubber band was fastened to the end of the splint and attached to lateral adhesive traction straps on the finger.

Figure 161 shows the position of the fragments after reduction. The wounds healed by granulation without apparent infection. Traction was maintained for two weeks and a short palmar splint was worn for one week longer. At the end of three weeks from the date of injury active and passive motion were encouraged and the patient rapidly regained the use of his finger. Figure 162 shows the phalanx nine months after injury. As you see, the function of the finger is perfect (Figs. 163, 164), the only apparent result of the injury being some shortening of the phalanx.

CLINIC OF DR. CHARLES GORDON HEYD

The New York Post-Graduate Hospital

HEPATITIS, CHOLELITHIASIS, HYDROPS OF GALL-BLADDER

Hepatitis Associated with or Sequential to Inflammatory Disease of the Abdomen. Frequency of Various Types of Hepatitis in Infections of the Right Upper Quadrant. Cholecystitis is Usually Only a Part of a More Wide-spread Condition. Discussion of Hepatitis and Biliary Infection. Cholecystectomy. Excision of Piece of Liver Tissue. Histologic Data on Hepatitis.

History.—The patient I am presenting this morning is a woman forty-seven years of age, married, born in Greece, and has resided in the United States during the last eighteen months. She entered the New York Post-Graduate Hospital complaining of a "lump" in the right upper abdomen, with constant pain of a dull heavy character, for the past three months. The family history of the patient is unimportant, and her own personal history is in no way noteworthy except for intermittent attacks of fever of short duration, supposedly due to some endemic infection at Malta. The patient has never had typhoid and has, by her own statement, enjoyed comparatively good health. She is the mother of 8 children, all normal deliveries, with no obstetric complications. The present illness began three years ago with the sensation of fulness in the upper portion of the abdomen. This fulness or sensation of distention was present more or less constantly and was uniformly made worse by the ingestion of food. After eating, particularly greasy food, there was a constant desire to belch gas, and the patient experienced relief when she was able to eructate gas, and always obtained complete relief by inducing vomiting. At times the sensation of weight and fulness would be slight or even disappear, and at other periods would be much exaggerated, the variability in intensity apparently being without any adequate cause. A year ago the patient had an acute attack of pain which came on suddenly about midnight, of marked intensity, colicky in character, and for which she took bicarbonate of soda, with no relief, and later called a doctor, who gave her an "injection." On three distinct occasions in the intervening time she has had similar attacks of pain, the latest attack, three months ago, being more severe than those previously experienced. Following the most recent attack her husband noticed that the patient was jaundiced, and since then there has been a constant pain in the right upper quadrant, of a dull aching character. This pain is not colicky, is constant in its intensity and localization, and has slowly and continuously become worse. In the beginning it did not distress the patient, but in the last ten days has prevented sleep unless anodynes were administered. Shortly after the development of this constant pain the patient noticed a "lump" to the right of the navel, and this mass has become continuously larger from week to week. Until recently the tumor has not been tender, and the patient was not particularly impressed with this aspect of her condition until she made the observation that with the enlargement of the tumor her pain became progressively more intense. For the past three months the patient is under the impression that she has lost weight. At no period has she ever noticed that the stools were white or that her jaundice was more intense than at the present time.

Physical examination reveals a woman with moderate jaundice, apparently fifty years of age, and presenting the evidence of some loss of weight. There is a distinct jaundice of the sclera. The pupils react to light and accommodation and the patellar reflexes are normal. The examination of the chest and heart is negative. The abdomen reveals a mass in the right upper quadrant which moves with respiration. The tumor appears to be semisolid, yet gives a distinct impression of being fluctuant; it has the distinct shape of a Bartlett pear and presents all the characteristic features of a hydrops of the gall-bladder. The chemical blood examination shows: urea nitrogen, 19.3 mg.; uric acid, 4.2 mg.; creatinin, 1.7 mg.; sugar, 0.12 per cent.; leukocytosis, 14,000 per cu. mm.; polymorphonuclears, 82 per cent. The Roentgen-ray examination by Dr. Wm. H. Meyer shows the kidneys of comparatively normal shape, size, position, and illumination. There is no evidence of calculi in either urinary tract. Calcareous deposits noted in the upper abdomen are due to calcification of the costal cartilages. The Roentgen-ray examination of the gastro-intestinal tract shows a stomach of medium size, of the orthotonic type, with hypotonic tendency, its axis vertical. The stomach is situated mainly to the left of the median line; this displacement is apparently due to mass-pressure in the right upper abdomen, since not only the stomach but the small intestine and hepatic flexure appears displaced somewhat to the left. Otherwise there is no defect in gastric outline. The bulbus is of medium large size, somewhat elongated, its summit rising fairly high, sharply kinked, and surmounted by a gas-bubble. Peristalsis is visualized over both curvatures and is not exaggerated. Evacuation is at first delayed, but is later improved, especially by palpation. The bulbus, on the other hand, is slow to empty. There is an infinitesimal speck of residue in the bulbus at the end of six hours. There is no evidence of hypersecretion. The motor meal expelled shows a hypomotility; the major quantity is still in the ileum at the end of six hours. The cecum is depressed, the ascending colon, as above noted, is somewhat displaced to the left, with evidence of a large oval-shaped mass in the right abdomen. Though somewhat constricted above, the shadow of this mass appears to fuse with that of the liver. The fact that the kidney outline on this side has previously been visualized practically excludes a renal tumor. Tentative *x*-ray diagnosis: Hydrops of the gall-bladder or a cystic tumor attached to the liver.

Clinical Diagnosis.—Cholecystitis, hydrops of the gall-bladder, cholelithiasis, associated hepatitis.

The diagnosis of this woman's condition is comparatively simple and is based upon three different lines of inquiry, all important. There is first the history; second, the physical examination; third, the Roentgen-ray examination. I would place their relative importance in the order in which I have presented them. Outstanding and occupying a place entirely distinct and by itself is the history. The chronologic sequence of events in this patient's narrative is succinct and diagnostic. In all its essential characteristics it is the history of gall-bladder infection. It is a long story of suffering, but without marked disability, without marked inpairment of health, and without any great depreciation in her general well-being. If we analyze the component elements that enter into the patient's history we find that there are four distinct features in its evolution: the long period of gaseous indigestion; the attacks of severe pain, colicky in character and requiring a hypodermic for its relief; the occurrence of jaundice after the last attack of colic; and finally, a constant localized pain with tumor in the right upper quadrant.

Probably the most frequent symptom numerically in abdominal conditions is that of dyspepsia. The stomach by reason of its muscular apparatus and rather close proximity to the outside world by way of the esophagus may be spoken of as the voice of the upper abdomen, and malfunction of the upper intestinal tract induces quite early the symptoms of indigestion. Again, dyspepsia is one of the most common reflex disturbances of general constitutional disease. The elaborate statistical work of Cabot classifies indigestion in so far as the etiologic factor is concerned as follows: (1) tuberculosis; (2) cardiac disease; (3) affection of the kidney; (4) neuroses and psychoneuroses; (5) nephritis; while dyspepsia from exhaustion, debilitation, industrial overstrain, and alcoholism are so commonplace as to be beyond statistical computation. The classification of causes of dyspepsia from large clinics has shown that of 100 persons complaining of indigestion, approximately 40 per cent. have the cause of their dyspepsia in organs entirely remote from the abdomen, while 40 per cent. have the etiologic factor within the abdomen, but remote from the stomach, and less than 20 per cent. have actual organic disease of the stomach. The last decade has witnessed the gradual reduction in the number of so-called neuroses of the stomach with an extension of the organic causes of stomach disease. As a very commonplace example of indigestion from causes entirely remote from the abdomen one has only to recall that approximately 10 per cent. of all cases of locomotor ataxia have been operated upon for a supposed abdominal condition and usually for a supposed ulcer of the stomach, gall-bladder condition, or a diseased appendix. For practical purposes when we consider ulcer of the stomach, cancer of the stomach, affections of the biliary system, and disease of the appendix we will have considered 95 per cent. of the surgical affections of the abdomen. We believe that in the symptomatic evolution of each of these conditions there is, as a rule, a clear-cut and distinct picture and that the history properly interpreted will lead to the correct anatomic diagnosis in at least 90 per cent. of the cases.

If one made a study of a sufficiently large number of cases of biliary disease he would find that he could catalog the patients into four distinct clinical groups: (1) those that complain of indigestion only; (2) those that give a history of acute attacks of biliary colic with or without preceding indigestion; (3) those that give a history of biliary colic and also the history of jaundice; (4) those who give any of the above histories and develop the complications of biliary disease—carcinoma, pancreatitis, duodenobiliary fistula, etc.

The early symptoms of cholecystitis, whether calculous or non-calculous, are the symptoms of an indigestion of which the chief complaint is "gas in the stomach." For a variable period of time these patients complain of a sense of weight and fulness in the stomach, present after small meals and relatively worse after large meals. Upon belching gas there is obtained some relief, and a not uncommon history is that of a patient leaving the dinner table and inducing vomiting with complete amelioration of symptoms. The gas production is in a measure dependent upon the quality of the food—carbohydrates, fats, starches, nuts, and some fruits induce a greater degree of gas production. These patients are treated for nervous indigestion or gastritis when they have a chronically diseased gall-bladder with thickened walls and a loss of the normal distensibility of the gall-bladder. Into this history there may ensue at a later period, or without this history of indigestion the first indication of biliary trouble may be ushered in by an attack of acute, sharp agonizing pain which comes on like a stroke of lightning, is of maximum intensity, and is associated with restlessness and movement upon the part of the patient. There is a strong desire to lean over a chair or to grip the lower part of the thorax. With this is usually associated nausea and vomiting. The attacks of pain have a predilection for nocturnal occurrence and are so severe as to require hypodermics of morphin for their control. The characteristic and outstanding feature is the lightning-like onset of the pain, without premonition or warning and its intensity requiring morphin. After four to eight hours the pain disappears almost as rapidly as its onset, leaving behind a residual soreness along the right costal margin. The third clinical group is characterized by a history somewhat after the fashion of the preceding types, with the exception that after an attack like the above the patient is jaundiced, and in this group we have a trinity of symptoms—colic, jaundice, and fever. This jaundice is associated with colic and usually with chills, fever, and sweating, and for many years masqueraded under the title of Charcot's intermittent hepatic fever, and was variously ascribed to malaria.

Jaundice is a symptom of sufficient magnitude to make a patient apprehensive. If one considers the diagnostic possibilities of jaundice he will find that aside from catarrhal jaundice—a condition founded upon insecure pathologic information—which is characterized by slight constitutional disturbance and uniformly resolves and clears up in four to six weeks, we have essentially a differentiation of jaundice produced by neoplasms and the jaundice produced by calculous disease of the biliary apparatus. Stupor is only associated with jaundice in cirrhosis and acute yellow atrophy, while emaciation is uniformly present in all types of chronic jaundice irrespective as to the etiologic factor. The onset of jaundice with colic predicates an infective process, and since 98 per cent. of all gall-stones have had their origin in infective changes in the gall-bladder, we find that the gall-bladder in chronic calculous cholangitis is atrophied, thickened, or undergoing fibroid contracture, and is non-palpable on physical examination unless there is an accidental occlusion of the cystic duct with hydrops of the gall-bladder.

The history of this patient has revealed a chronic gaseous indigestion with attacks of colicky pain and jaundice—a trinity of symptoms which renders a diagnosis of biliary disease almost positive. On physical examination we find a mass in the right upper quadrant, cystic in character, which we interpret as a hydrops of the gall-bladder. This opinion as to the essential nature of the tumor is strongly confirmed by the Roentgen-ray examination. If we look at our available diagnostic data from another angle we have in this case an exception to the so-called Courvoisier law, which states that in cases of chronic jaundice due to blocking of the common duct a contracted and atrophic gall-bladder signifies that the obstruction is due to stone; a dilatation or distention of the gall-bladder that the obstruction is due to causes other than stone.[1] The exceptions to Courvoisier's law are few. Seriatim, they may be noted as follows: (1) Stone in the cystic duct with hydrops or empyema of the gall-bladder and associated with adjacent infection of the common duct. Our case represents a classical example of this type of mechanical occlusion of the cystic duct with hydrops; (2) acute cholecystitis with obstruction of the cystic duct and stone in the common duct; (3) chronic pancreatitis with stone in the common duct; (4) a stone in the cystic duct with compression of the common hepatic duct; (5) malignant disease along the course of the common duct with an old chronic fibroid cholecystitis. It is evident that we have a cholecystitis with hydrops, probably due to calculous obstruction of the cystic duct, and inferentially an associated hepatitis. The presence of hydrops in this particular patient is incidental or accidental, representing an occluded cystic duct, and is in no way essential to the diagnosis of gall-bladder disease, and serves only to explain the constant character of her pain in the last three months and to provide an exception to Courvoisier's law.

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[1] Surgical Clinics of North America, Vol. I, No. 2, p. 540, Saunders, 1921.

Discussion.[1]—In attempting to interpret disturbed physiology in disease of the external biliary apparatus we must recognize that the liver and its ducts are but one part of the alimentary system and physiologically conform to the fundamental neuromuscular mechanism that applies to the entire alimentary system. The underlying basis of the physiologic action of the gut tube is embraced in the so-called law of the intestine, a name given to it by Bayliss and Starling, sometimes called the law of contrary innervation of Meltzer. In simple language this law means that local stimulation of any segment of the intestinal tube causes a contraction above and a relaxation below the stimulated part. There is always a contracting impulse at the cephalic end and an inhibitory impulse at the caudal end. As a corollary to the principle of rhythmicity of gastro-intestinal movement it has been demonstrated that whenever there is an irritation of the gut tube, that portion of the alimentary tract above the point of irritation participates in the beginning in an exaggeration of its normal function. Meltzer asserted that the law of contrary innervation is manifested in all functions of the animal body, and a disturbance of this law is a factor more or less important in the pathogenesis of many disorders and diseases of the animal body.

When we survey the gastro-intestinal tract we are impressed with the fact that in the scheme of nature there are normal points of stasis. In the gall-bladder we have a point of natural or physiologic stasis, and we might well question if it is not possible for a physiologic state of stasis to become lengthened out into a condition with distinct pathogenesis. In other words, we may pass from a physiologic stasis into a pathologic stasis. In the upright position the fundus of the gall-bladder is at a lower level than its outlet. This morphologic arrangement is true of all viscera that contain fluid and presupposes the ability of the organ to exercise contractile power and expel at least some portion of its contents. The gall-bladder, however, is incapable of completely emptying itself, and although non-striated muscle-fibers are contained in its wall, they are without any definite arrangement into a distinct muscle layer, and are too sparsely distributed to make a complete evacuating organ. In spite of the paucity of muscle-fibers the gall-bladder undergoes spontaneous rhythmic contractions from eight to ten times a minute. The lymphatic supply to the external biliary system is extremely rich and there is no anatomic partition or barrier between the intrahepatic and extrahepatic lymphatic distribution. The bile within the gall-bladder is materially different from the bile secreted from the liver or from the bile contained within the ducts. The former is concentrated, darker in color, has a higher specific gravity, and is chemically changed by the addition of mucin and nucleo-albumins. Rous and McMaster recently demonstrated that the passage of bile through the cystic duct concentrated the bile from two to four times, while the gall-bladder is capable of concentrating the bile ten times in twenty-four hours.

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[1] The discussion followed the conclusion of the operation, but for continuity of interest is inserted here.

The secretion of bile is continuous, yet it is delivered into the duodenum intermittently. In other words, we have a continuous secretion with periodic delivery. Correlated with this is the fact that the secretory pressure of the bile as it descends from the liver through the common duct is by and of itself insufficient to overcome the sphincter of Oddi; even with the addition of the contractile pressure of the gall-bladder there is not sufficient pressure to overcome the normal tonicity of the sphincter. There is required for physiologic relaxation of the sphincter an inhibitory impulse to allow the ejection of bile into the duodenum. From a neuromuscular point of view the muscle-fibers of the gall-bladder and the sphincter of Oddi at the ampulla of Vater are antagonistic in their action, and in a normal physologic biliary system the contraction of the former implies relaxation of the latter. During the fasting state the duodenum is free from bile, and it has been demonstrated that the introduction of acid chyme, peptones, albuminose, or the irritation of the duodenal mucosa by a thread or a duodenal tube is sufficient to inhibit the sphincter of Oddi and bring about the delivery of bile. The fact that nature planned an intermittent delivery of bile into the duodenum must have a reason. It must be conceded that in the absence of gastric contents bile should not be present in the duodenum. This is a functional advantage to the individual and represents a protective mechanism in order to have the duodenum empty of bile when there is no physiologic demand for it. Morphologically the bile is delivered just at the partition between acid and alkaline digestion, at the point of transformation of chemical activity from an acid to an alkaline medium. The evacuation of gastric material in small amounts and at frequent intervals corresponding to the relaxation of the sphincter of Oddi clearly predicates that the bile will be delivered into the duodenum in response to the normal physiologic demand.

The bile is not purely an excretion, for the bile salts are reabsorbed and undergo a more or less continuous circulation. One has only to recall the very marked improvement that takes place in patients who are losing bile through common duct drainage when they are fed their own bile. So impressed are we that in all cases of common duct drainage we feed the patients their own bile. Cokeman demonstrated that soon after a biliary fistual has been established the salts in the bile fall to one-tenth of the normal, since reabsorption cannot occur. This suggests that normally bile salts are excreted and reabsorbed ten times before being destroyed or eliminated. Bile is, therefore, delivered into the duodenum as the summation of three factors, the hepatic secretory pressure; the expulsive force of the gall-bladder, plus the ascent and descent of the diaphragm during respiration providing a "milking action." The maximum pressure exerted by the three is insufficient to overcome the tonicity of the sphincter unless another factor is brought into play, namely, the relaxation of the sphincter of Oddi.

At one time gall-stones were considered the only pathologic evidence of a diseased gall-bladder, and the finding of stones was interpreted as the essential pathologic lesion. We know that this is incorrect and that it is the infective process in the gall-bladder or the biliary system that induces the pathologic change and provides the surgical indication. It is the deeper tissues of the gall-bladder that are more particularly involved, and 20 per cent. of the lesions of the gall-bladder that require surgical intervention are characterized by the absence of gall-stones.

There are four theoretic ways in which the gall-bladder may be infected. Of these, one presupposes a mucosal infection, the infecting organism reaching the gall-bladder either by ascent from the duodenum or descent from the liver. Laboratory experiments demonstrate that it is with the utmost difficulty that the gall-bladder can be infected from within its cavity. The injection of virulent streptococci into the interior of the gall-bladder does not produce gall-stones. Other pathologic factors must be brought into play which lessen the resistance of the tissue beneath the mucosa. Coffey has demonstrated that the duodenum will rupture under pressure before there is a reflux of material up the common duct. It does not seem probable that cholecystitis commonly arises from infection by way of the mucosa. Two other possibilities for infection of the gall-bladder are the bringing of infectious material through the blood-stream

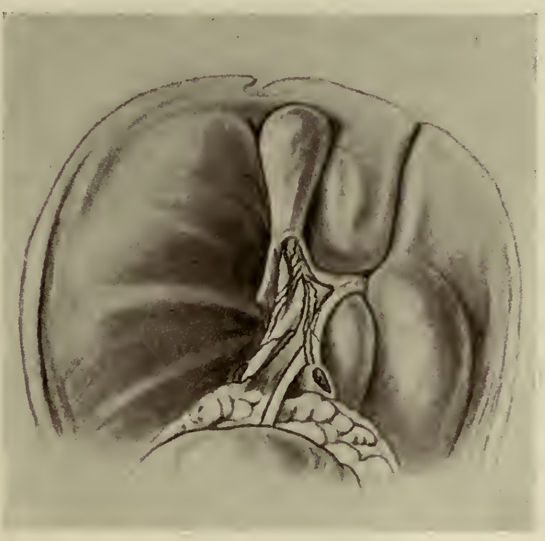

Fig. 165.—The lymphatics from the gall-bladder passing down along the common duct to the head of the pancreas (Franke).

or by contact from contiguous viscera. If the blood-stream is the means of infection, we must distinguish a straight hematogenous infection and an infection by means of the portal system. Rosenow, in a series of very beautiful experiments, demonstrated the possible source of cholecystitis from infectious emboli in the walls of the gall-bladder and drew attention to the relative affinity of certain types of bacteria for the tissues of the biliary apparatus. That this is a method of infection in certain cases cannot be denied, but it must be relatively infrequent by reason of the comparative rarity of embolic processes of the gall-bladder in any of the accepted forms of bacteremia. If the vascular systems, either systemic or portal, were at fault one would expect that the liver as well as the gall-bladder would show uniform changes throughout its substance, but this is not true, for we find that in infections of the gall-bladder that it is the right lobe of the liver that is preponderantly involved, and particularly that portion in intimate contact with the gall-bladder.

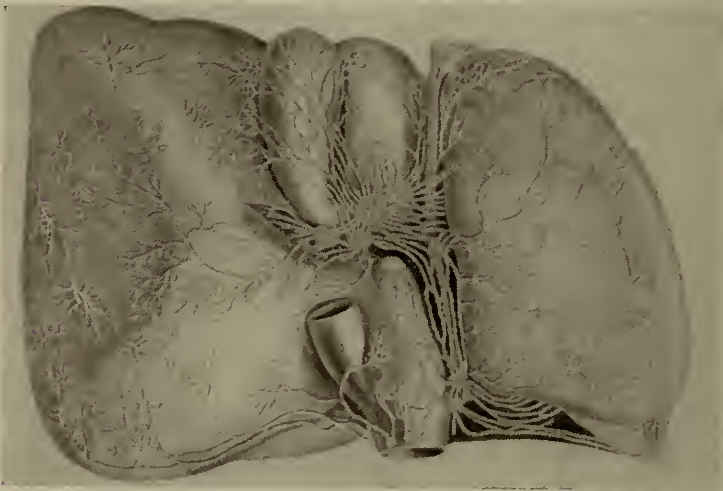

Fig. 166.—Anastomosis between the large lymphatic trunks on inner surface of gall-bladder (liver everted) and liver. Common connecting trunks passing to glands at hilum of liver. Anastomosis between lymphatics of gall-bladder and liver, particularly noteworthy in front and at the side of the gall-bladder (Sappey).

The fourth method for infecting the gall-bladder would be by means of the lymphatic circulation, and it has been demonstrated by Franke (Fig. 165), Sweet, Deaver, and Pfeiffer that there is a very intimate and extensive lymphatic connection between the gall-bladder, liver, common duct, and pancreas. Anatomically, according to Sappey, Sudler, and Graham, there is no separation between the extra- and intrahepatic system of lymphatics (Figs. 166, 167), and a hepatolymphatic infection would offer a reasonable basis to account for most of the cases of cholecystitis.

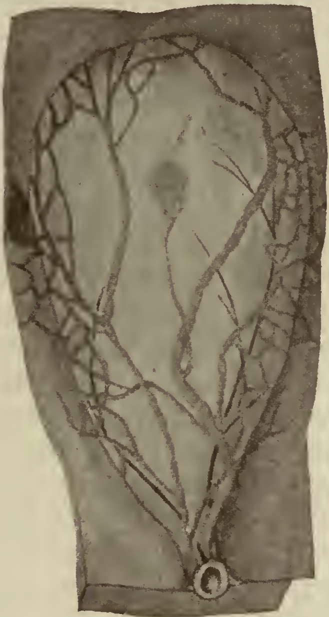

Fig. 167.—Free communication between lymphatics of liver and gall-bladder (Sudler).

It seems logical to believe that in the majority of cases cholecystitis represents a direct infection of the wall of the gall-bladder from an infected liver. Infection reaches the liver by the portal vein, involves the periportal tissues and induces a pericholangitis with involvement of the intra- and extrahepatic lymphatics, thereby bringing by direct extension an infection of the walls of the gall-bladder. This would offer an explanation for the cholecystitis that is coincident with appendicitis, peptic ulcer, typhoid fever, and suppurative hemorrhoids.

It has been our experience that the diseased gall-bladder without stones is distinctly a greater menace to complete recovery and future well-being than is the less grossly changed gall-bladder with stones. The palpatory diagnosis of disease of the gall-bladder in cases not characterized by the presence of stones is fallacious, and an opinion as to the normality of a gall-bladder simply upon palpation through a lower abdominal wound is seriously open to question. There are, however, certain criteria which in the absence of calculi may collectively be taken to indicate that a particular gall-bladder is pathologic. Seriatim these may be defined as follows: (1) A loss of the normal color—under normal conditions the gall-bladder is never white, brown, or mottled, but always possesses its distinctly olivary green tinge. It is essential that the color of the gall-bladder be noted upon opening the abdomen, for upon exposure to the air it takes on a rather blanched appearance. (2) The walls of the normal gall-bladder are quite thin and any marked increase in the mural thickness bespeaks infection. (3) The deposition of saffron-colored fat well up to and on the fundus of the gall-bladder is distinctly abnormal and represents infiltration of the wall. (4) The presence of varying degrees of pericholecystitis is suggestive only. Personally we are unable to account for some of the many adhesions that exist between the duodenum and gall-bladder, including the so-called cysticoduodenal and cysticocolonic ligaments which Todd states are present in 1 out of 4 individuals. We have found adhesions in apparently normal persons so frequently without any disabling angulations, and so far as we can determine in patients free from upper abdominal symptoms, that the finding of occasional adhesions between the gall-bladder and colon in the absence of symptoms must be accepted as of minor value in determining the degree of pathology in the gall-bladder. (5) The inability to express bile from the gall-bladder by manual compression is of very little diagnostic importance and is not necessarily indicative of pathologic change. By the peculiar S-shaped conformation of the cystic duct and ampulla the gall-bladder can be distended almost to the point of rupture without allowing any bile to flow through the cystic duct. Adhesions angulating the cystic duct can bring about the same condition without intrinsic disease of the gall-bladder being evident. (6) The presence of hyperplastic lymph-glands along the course of the cystic and common ducts is indubitable evidence of infection of the biliary system, for the mechanism of lymphadenitis is the same in the biliary system as it is elsewhere in the body, and adenitic hyperplasia represents infective irritability. (7) The finding of a papillomatous mucous membrane rather than the normal smooth type with minute cholesterin crystals embedded in its substance is of primary importance in the diagnosis of the so-called strawberry gall-bladder. We place little value in the so-called inspissated bile as an evidence of infection primarily because it is the normal condition for bile to be inspissated or concentrated within the gall-bladder. (8) The presence of white plaques extending from the serosal covering of the gall-bladder to the under surface of the liver. They represent, to our mind, fibrosis in the liver tissue concomitant or sequential to gall-bladder infection. An infected gall-bladder, with or without stones, we believe, is an expression of a pathologic change more wide-spread and extensive than that which is represented in the gall-bladder itself. One has only to recall the clinical association of hepatitis with appendicitis, ulcer of the gastroduodenal segment, pancreatitis and gall-bladder, to infer that there is a definite pathologic association between any or all of these affections. The association of glycosuria with primary disease of the gall-bladder and its subsequent cure after operative relief of cholecystitis has been made frequently enough to show that there is more than an incidental or casual relationship. We have recognized for a number of years a cholecystic toxemia which manifests itself by changes in organs quite remote from the liver. During this period of time we have also been impressed with the macroscopic picture of the liver in patients operated upon for chronic disease of the biliary tract. There was a well-founded idea that many of these cases show definite liver changes either subsequent to infection of the gall-bladder or coincident with gall-bladder infection. From time to time in checking up our after-results we have been impressed with the clinical fact that those patients who showed gross demonstrable changes in the liver at operation, either in the form of fibrous trabeculæ, enlargement of the right lobe of the liver, scar formation over the surface of the liver, or changes in color, were those least benefited by the gall-bladder surgery. We are convinced that there is a type of liver disease that is concomitant of long-standing gall-bladder infection that leaves the patient a more or less invalid irrespective as to the type and kind of surgery employed.

Our pathologic interest in hepatitis was stimulated by two very splendid contributions, one by E. A. Graham, entitled "Hepatitis, An Accompaniment of Cholecystitis," appearing in Surgery, Gynecology, and Obstetrics, May, 1918, and the second one by Peterman, Priest, and Graham entitled "The Association of Hepatitis with Experimental Cholecystitis and its Bearing on the Pathogenesis of Cholecystitis in the Human," appearing in the Archives of Surgery, January, 1921. Graham demonstrated by the removal of a piece of liver from cases that came to operation for cholecystitis that there existed the microscopic evidence of hepatitis and that this inflammation appeared to be in the nature of a pericholangitis. It is interesting to note that when hepatitis occurred presumably secondary to cholecystitis the right lobe of the liver was much more frequently affected than was the left, and such changes as did occur in the right lobe of the liver were always more predominantly marked in the area of the gall-bladder (Fig. 168).

Adami has demonstrated that under normal conditions colon bacilli may be present in the blood-stream and eliminated from the liver in apparently normal bile, so that the mere presence of bacteria in the bile-stream may or may not influence us in our conception of primary liver change. The liver may be infected presumably in four ways: (1) Hematogenous infection. (2) By means of the portal system. (3) Through the lymphatics. (4) From contact with contiguous pathologic organs.

Infection of the liver by means of the arterial blood-stream is a well-known method and concerns itself with embolic processes and in septicemic states. Acute infection of the liver through the portal system has its clinical pathology demonstrated in septic pylephlebitis following appendicitis. These are essentially acute processes and do not interest us at this time. Chronic liver changes by means of the portal system is expressed in its most typical form in portal cirrhosis.

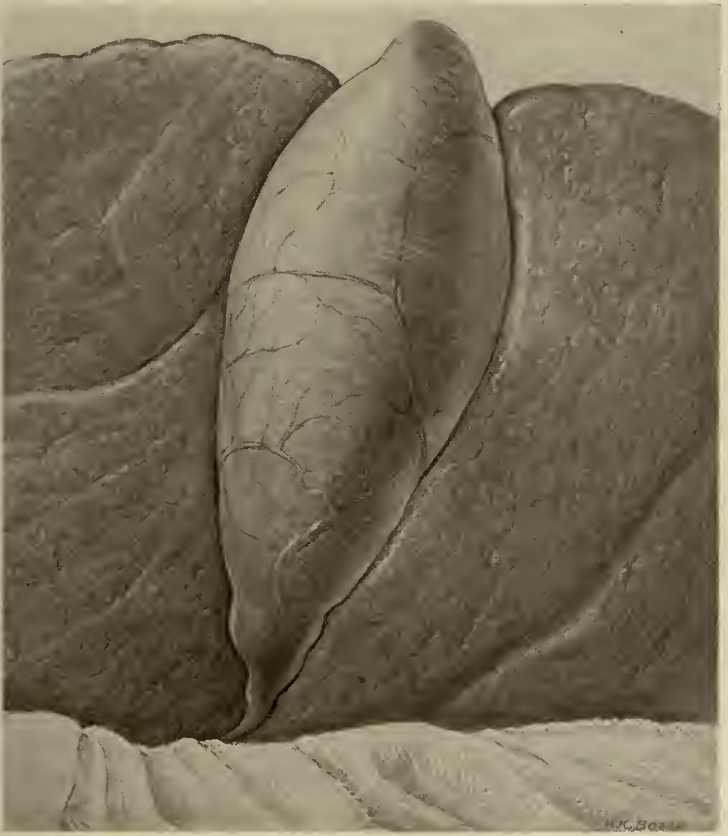

Fig. 168.—Actual drawing made at operation, showing hydrops, crenation of liver edge, dimpling of liver surface with area of fibrotic replacement, and the marked increase in fibrous tissue trabeculæ.

In the type of hepatitis with which we are concerned there is a pericholangitis of the minute bile radicles, and this condition is found in association with inflammatory conditions in the abdomen. An infection of the liver from the gall-bladder or an infection of the gall-bladder from the liver must occur in one of two ways—either through the lymphatics or through the veins. If the liver is infected from a primarily diseased gall-bladder by way of the veins the microscopic evidence of that liver involvement should correspond to the equitable distribution of the veins throughout the liver. This does not occur, but changes in the liver are greatest in the region of the gall-bladder and diminish inversely with the distance from the gall-bladder. If the liver is primarily involved and gall-bladder secondarily it is reasonable to presume that the infection of the gall-bladder takes place by means of the lymphatics.

A consideration of the anatomy and morphology of the liver is of value in anticipating the mechanism of hepatic degeneration. The liver, the largest gland in the body, is concerned with the most diverse of metabolic functions. In the metabolism of fats, carbohydrates, and sugars it occupies a place in body chemistry all its own. In its ability to detoxify chemic and biochemic irritants it is one of the chief safeguards in preventing inundation of the system with incompletely destroyed toxic by-products. As the manufactory of bile, viewed either as an excretion or secretion, it occupies a separate physiologic field and, in turn, the liver is intimately associated with the diverse chemistry of pancreatic digestion and intestinal assimilation. The liver stands midway as a buffer state between general and portal circulation and is an efficient filter between the by-products of splenic circulation and the general circulation. It derives its arterial blood from the hepatic artery, but two-thirds of this arterial blood is diverted to the cystic, gastric, and supraduodenal arteries, so the actual amount of oxygenated blood going to the liver is comparatively small.

One has only to compare the arterial blood of the liver with the arterial blood sent to the spleen or kidney, the latter two organs performing their functions in the presence of an adequate or ample oxygenated blood. The liver, on the contrary, per-forms all of its functions upon blood that is essentially nonoxygenated, as the liver cells receive blood only from derivatives of the portal vein, the hepatic artery supplying the walls of the blood-vessels, the bile-ducts, and the liver capsule. The liver reacts to long-continued or habitual toxic irritation by two pathologic processes—one the degeneration of liver cells and the other the proliferation of connective tissue. These processes apparently go on simultaneously, and as to which is primary and which is secondary is of academic interest only. Certain it is that degenerating areas are replaced by connective tissue and intracellular material, and that by replacement or contraction there is atrophy of liver parenchyma.

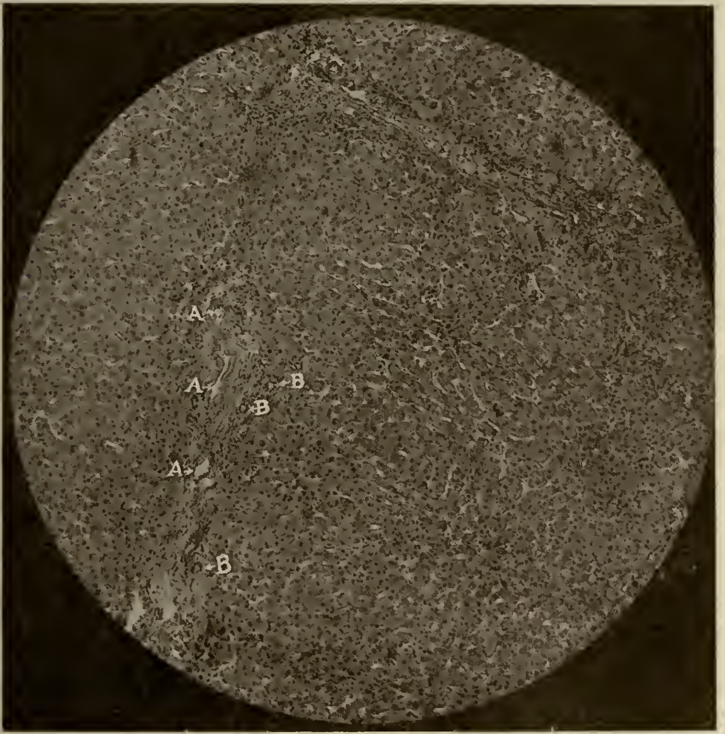

Fig. 169.—Early stages of biliary cirrhosis. There is a moderate thickening of the trabeculæ of Glisson's capsule with excess of wandering cells in them, particularly near the bile-ducts: *A*, Portal branches; *B*, bile-ducts.

By a consideration of the histologic architecture of the liver lobule pathologic changes may be rendered comparatively simple. By means of an essentially similar cell contact on one side with portal blood and on the other with bile radicles we have a dual mechanism for irritation of the hepatic cells. If the portal radicles bring the offending agent to the liver cells, we have changes in the way of a round-cell infiltration and replacement, fibrosis taking place about the veins and giving varying degrees of portal cirrhosis. If the irritating agent is contacting with the liver cells through the biliary system the same mechanism

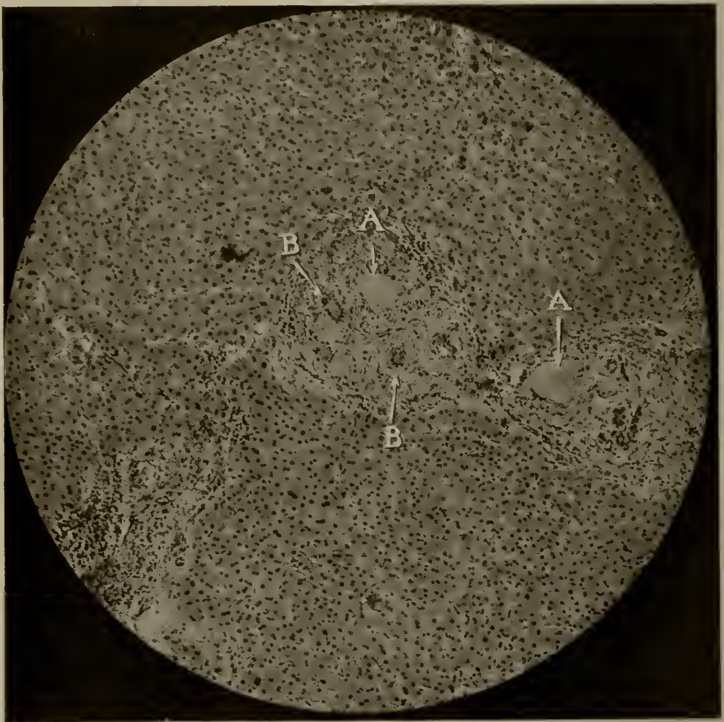

Fig. 170.—Chronic interstitial hepatitis and moderately early stage of biliary cirrhosis. The fibrous thickening of the trabeculæ is more marked than in Fig. 169 and the round-cell infiltration is relatively less rich, but again somewhat more nearly related to the bile-ducts than to the portal branches: *A*, Portal branches; *B*, bile-ducts.

takes place with round-cell infiltration and fibrous replacement and we have the histologic picture of a biliary cirrhosis (Figs. 169, 170).

By means of the high reparative power exercised by the hepatic cells the liver is capable of withstanding long-continued injury with but slight impairment of function, and the clinical condition of an individual as the result of continuous hepatic injury will depend upon the degree of involvement of the liver cells and the corresponding replacement by fibrosis. If the agent is acute and highly toxic the changes are rapid and in the nature of a fatty degeneration. If the irritating agent is more attenuated the pathologic picture is that of a round-cell invasion and infiltration with the development of fibrous tissue replacement. The patient for a long period of time may show no symptoms of hepatic insufficiency by reason of the compensatory action exerted by the liver. The final clinical outcome of hepatic exhaustion or marked hepatic insufficiency is stupor and coma, which are the inevitable terminal picture in acute yellow atrophy and in cirrhosis.

If we begin with a very benign liver change it is possible to pass gradually into more marked conditions of liver degeneration until the final outcome in acute cases is similar to acute yellow atrophy, and in chronic cases to portal cirrhosis. We believe that when an infection is once initiated within the abdomen and its course is chronic, the liver reacts in a variety of ways, but always with some degree of hepatic degeneration, and that in a certain proportion of cases surgical intervention in these cases is associated with or followed by death due primarily to hepatic insufficiency. This insufficiency is the result of two factors—one a chronic deficiency of liver function as the result of long-continued infection, and the second the sudden addition of an operative toxemia from the surgical intervention with trauma, etherization, and postoperative acidosis.

I wish to draw your attention to three clinical states that occasionally attend after operations on the biliary tract. The immediate postoperative deaths in biliary surgery are due in a large measure to mechanical or anatomic factors, such as hemorrhage, shock, gastric dilatation, and exhaustion. Seldom does the element of wide-spread infection or peritonitis become a lethal factor. We have observed complications after operation on the gall-ducts in which the mechanical causes of death could be eliminated and in which there was no evidence of infection, and in which cholemia or too rapid loss of bile would not explain the condition.

The most frequent of the three types of clinical pictures that we have observed after operations on the biliary tract is a condition of profound vasomotor depression. The patient ordinarily has been behaving quite as usual following an operation for cholecystectomy or drainage of the common duct. At the end of twenty-four to thirty-six hours, without any apparent reason, the patient passes into a pronounced state of vasomotor collapse, with cold, clammy extremities, wet, moist, and leaking skin, a very much stimulated mentality, and a facial expression not unlike the facies of fear. The condition is not associated with dilatation of the stomach and there has been ample evidence of kidney function. The intravenous administration of a 10 per cent. solution of glucose (1000 c.c.) every four to six hours, and continuous Murphy proctoclysis with tap-water, has usually brought about a recovery. It is interesting to note that when this type of complication occurs it has usually been in cases that have had a previous operation upon the gall-bladder, and at the second operation have had drainage of the common duct, with palpatory or manual manipulation of the pancreas. For want of a better explanation we have interpreted this type of picture as due to some pancreatic toxin or ferment liberated by the surgical trauma with inadequate liver protection.

A second type of clinical picture occurs after a varying period of time, usually the fifth day, in patients who have had a comparatively simple gall-bladder operation, but who have been chronically jaundiced. A normal convalescence has been progressing up to the time of the onset of a slight degree of somnolence. They may or may not have lost large quantities of bile through external drainage. They slowly become stuporous and in the course of twelve to twenty-four hours pass into coma.

The temperature rises to 103° or 104° F.; kidney function has been adequate previous to this. There is no evidence of infection within the abdomen and the condition is not one of dehydration following too rapid loss of bile through the drainage-tube. Nor has there been any increase in the obstructive cholangitis if this were present previous to the operation. We have here a condition not unlike the coma of cholemia in a patient who is adequately drained and who had no further increase of obstructive jaundice. We have fed these patients their own bile, either by allowing them to drink it or by giving it by stomach-tube, and have not prevented the fatal outcome by these procedures. This condition is essentially a coma, occurring in a patient with a diminishing obstructive jaundice. Are we dealing with a frank case of liver exhaustion similar to the terminal stages of a portal cirrhosis?

Less frequently we have observed a third type of clinical picture that supervenes immediately after operations on the gall-bladder. This type is infrequent, and it is interesting to note that it has occurred after rather simple types of operation on the biliary apparatus. This lethal complication has terminated, however, a long history of gall-bladder or biliary duct infection. These patients, as a rule, have not been jaundiced. The clinical onset is characterized by the onset of coma almost immediately following operation. The patient ordinarily does not recover from the anesthesia, a fact that should be noted. The temperature rises to 104° or 105° F., with marked acceleration of pulse, usually subsultus tendinum, carphology and talking delirium, and, more rarely, marked motor excitation. Chemical tests of the blood before operation demonstrated that kidney function was adequate and within normal limits. Spinal puncture after the onset of coma has revealed an increase in fluid under pressure, cell count of 10 to 15 per cubic millimeter, with 2+ globulin reaction, and negative Wassermann examination.

Dr. John A. Killian, Assistant Professor of Biochemistry of the Department of Biochemistry, New York Post-Graduate Medical School and Hospital, has undertaken the study of this condition, and we have been fortunate in being able to study the last 6 cases from a chemical point of view. Of outstanding interest has been the observation that these patients show a carbon dioxid combining power markedly increased above the normal, representing 81 to 100 volumes per cent. This has not been due to the previous administration of alkalines, and the condition has been designated chemically as an alkalosis (Fig. 171). So far as its fatal outcome is concerned it is much more pernicious than an acidosis. Of the 6 cases recently studied, 4 terminated fatally, and all of these were instances of chronic disease of the gall-bladder with simple operations.

There exists in the blood-plasma a buffer system, comprising acid and basic compounds. Under normal conditions the acid compounds are carbonic acid and acid phosphates, while the basic compounds are bicarbonates and alkaline phosphates.

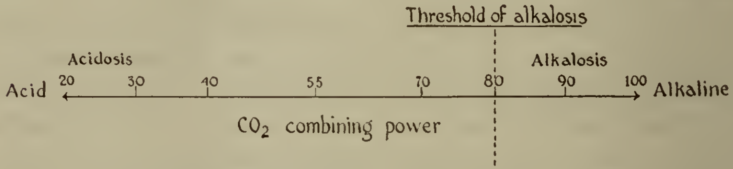

Fig. 171.—An increase in the carbon dioxid combining power toward 80 indicates an alkalosis; the reverse, an acidosis.

The normal blood-plasma shows a slight excess of the alkalies over the acids, this excess constituting the alkali reserve of the plasma. The range of the hydrogen-ion concentration in the normal plasma is then slightly to the alkaline side (Ph = 7.4 – 7.6). It is well known that an accumulation of abnormal acid bodies, *i. e.*, acetone bodies in diabetes, or an increased concentration of acid bodies normal present (*i. e.*, acid phosphates in nephritis) leads to a decrease of this alkali reserve, producing an acidosis. The most practical method of determining the extent of this alkali reserve is by measuring the amount of carbon dioxid that will combine with a definite amount (100 c.c) of blood-plasma; the normal plasma should take up 55 to 70 volumes per cent. of the carbon dioxid. A decreased carbon dioxid combining power indicates a lowered alkali reserve, *i. e.*, an acidosis. A decrease in this combining power to 40 indicates a moderate acidosis; to 30, a severe acidosis; and to 20, an acidosis which will probably prove fatal. Cases of acidosis are comparatively frequent and the methods of relieving it are well known.

With the more general use of Van Slyke's method for the study of the alkali reserve of the blood there has recently been noted a few cases in which the carbon dioxid combining power has been markedly increased above the normal, from 81 to 100 volumes per cent. A carbon dioxid combining power over 80 volumes per cent. would indicate the clinical and chemical condition of alkalosis. Whether this increased carbon dioxid combining power is associated with a decreased hydrogen-ion concentration has not been determined. The toxicity may be due to an accumulation of basic-ions alone, without an associated change in hydrogen concentration. These points are at present under investigation.

With the co-operation of Dr. Ward J. MacNeal, Professor of Pathology, New York Post-Graduate Medical School and Hospital, we are combining this chemical investigation of Dr. Killian with a minute histologic examination of portions of excised liver from both the right and left lobe of the liver in the attempt to obtain, if possible, a parallelism between the degree of pathologic changes in the liver and the disturbed chemistry exhibited in what we may call, temporarily at least, alkalosis.

Whether the liver is primarily at fault in the three clinical conditions that I have outlined we do not know. It does seem reasonable, however, to assume that they are in some way associated with liver dysfunction. In their terminal manifestations they simulate in many ways the clinical conditions that are observed in diseases of the liver where there is a manifest loss of liver function. It is interesting to speculate as to whether there are not conditions of liver insufficiency which give a variety of minor symptoms or that may exist without any symptoms for a long period of time by reason of the marked regenerative property of liver tissue. From the viewpoint of surgical prognosis may we not claim that these unrecognized cases of hepatitis are the cause of some of our unexplained mortalities, and that contribute much to the morbidity that sometimes follows apparently the most successful type of surgical intervention on the biliary system. Of the pathologic evidence as to the instance of hepatitis we have ample data. This data comprises microscopic and macroscopic changes. The work of Dr. Killian suggests the possibility of linking up disturbed liver function with measurable coefficients of carbon dioxid combining power. It is reasonable to suppose that inflammatory disease of the abdomen throws an injury upon the liver that if not interrupted by spontaneous cure or surgical intervention will produce the indubitable changes which we can recognize, pathologically at least, as chronic hepatitis.

Operation.—For a number of years we have been making a standard type of incision in this clinic for exposing the contents of the right upper quadrant and for operative approach to the gall-bladder, common duct, and duodenum. The incision begins midway between the ensiform cartilage and the right costal margin, extends downward and slightly outward to the right, terminating 1 inch to the right of the navel. This incision allows us to increase our operative field either upward or downward, and with a Balfour retractor inserted in the upper angle gives us adequate and ample room for operative manipulation. The course of the incision is roughly parallel to the line followed by the common duct. We have seldom used the transverse incision and rarely the hockey stick or the S incision, and it is over ten years since we used the oblique incision in operations on the right upper quadrant. The edges of the wound are protected by laparotomy pads for two purposes, first, to prevent undue or unusual traumatism of the easily infected, non-resistant fat, and second, to prevent soiling in our manipulation of the infected viscera. In all cases where the peritoneal cavity is free from infection we carry out a systematic exploration of the abdominal contents in the following order: (1) The examination of the stomach and gastroduodenal segment; (2) the lifting of the transverse colon upward and to the left and inspection of the duodenojejunal angle at the base of the mesocolon; (3) the palpation of the spleen; (4) palpation of the sigmoid, colon, and pelvis; (5) palpation of both kidneys; (6) elevation of the cecum and exposure of the appendix. Of course, if the peritoneal cavity is soiled or infected, this exploration is omitted. These exploratory maneuvers require very little time, are without danger, and permit us to obtain a comprehensive knowledge of the remainder of the abdomen. It is important to carry out a systematic exploration of the abdomen, for some 20 per cent. of patients operated upon have two conditions at one and the same time, either one of which reasonably demands surgical treatment. The number of instances of fibromyoma associated with disease of the gall-bladder, of tubal and adnexal disease with affections of the right upper quadrant, of appendicitis and gastroduodenal ulceration, of salpingitis, and appendicitis are sufficiently numerous to warrant an operative record of all the pathologic conditions that can be determined by palpation in the opened abdomen.

We make it an almost invariable rule to remove the appendix when operating for affections of the right upper quadrant. It is not a mere incidental relationship which is revealed between ulceration of the gastroduodenal segment and appendicitis and between cholecystitis and disease of the appendix. It is a causal relationship, for there is microscopic evidence of chronic inflammatory disease of the appendix in over 60 per cent. of the cases with ulcer of the stomach and duodenum. In 58 per cent. of the cases requiring cholecystectomy there is a chronic appendicitis. Contrast this with 16 per cent., which is the normal postmortem incidence of disease of the appendix, and we readily see the close interrelationship between pathologic changes in the appendix and disease of the right upper quadrant.

We have made our incision and the edges of our wound are adequately protected. We see the omentum crowding into the wound and overlying but not adherent to an enlarged, glistening white gall-bladder. The liver shows a very marked Riedel's lobe; the right edge of this lobe extends downward almost to the level of the crest of the ileum. I should judge that the entire liver is probably about 35 per cent. larger than normal. You will notice that most of this enlargement is in the right lobe of the liver. Riedel as long ago as 1881 thought that the linguiform process of the right lobe of the liver which now bears his name was due to disease of the gall-bladder, such as inflammation, calculi, or traction from adhesions.

It is interesting to recall that Silvestri and others attempted to segregate liver function in regard to the right and left lobe of the liver. It has been a frequent observation that when the liver is enlarged in diabetes the right lobe is affected, while in Banti's disease and other splenomegalias it has been observed that the left lobe participates more particularly. The work of Glenard and Serege lends emphasis to this contention, for in their experiments the left lobe of the liver was intimately con-

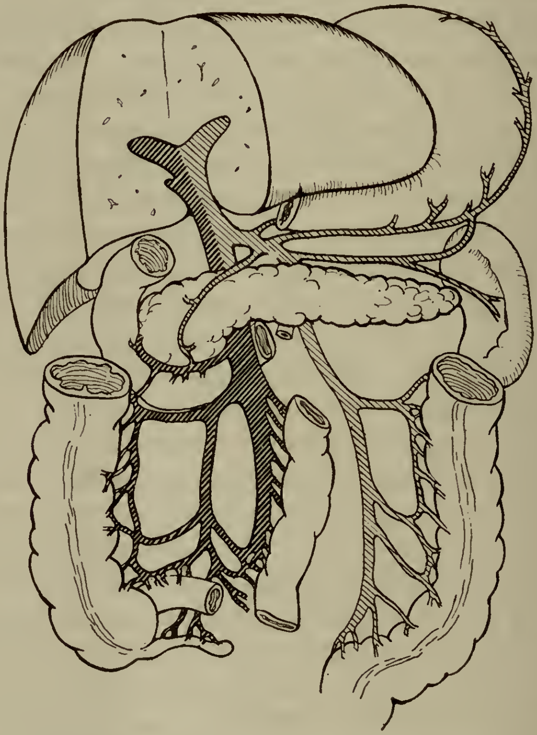

Fig. 172.—Diagrammatic representation of the segregation of the portal blood-stream in regard to its ultimate distribution throughout the liver. The right lobe shows more intimate relationship with pylorus, gall-bladder, and small intestine; the left lobe with stomach, spleen, and large intestine.

nected with the stomach and spleen, while the right exhibited more definite relationships with the pancreas and small intestine. The injection of staining fluids into the spleen invariably produced discoloration of the liver limited to the left lobe, while injections into the superior mesenteric veins, as a rule, stained the right lobe of the liver more than the left (Fig. 172).

You will notice extending back from the gall-bladder there are lines of white fibrous tissue, that there is dimpling of the surface of the liver evidently due to fibrous contraction of the trabeculæ of the capsule of Glisson. At various points along the edge of the liver there is marked indentation most prominent in the region of the gall-bladder and again about 5 cm. external to it. You will observe the dimpling and crenation of the under surface of the liver; you can readily see the white fibrous areas on either side of the gall-bladder (see Fig. 168). The gall-bladder is quite large, measuring approximately 15 by 7 cm. It is entirely without any green or olivary green color. Its wall is more or less thickened and contains "white bile." In obstructive conditions at the ampulla of Vater it is usual to find the gall-bladder distended with bile. This is not necessarily always the case, as a distinct hydrops with clear mucoid material may be present with patulous hepatic and common ducts. The presence of so-called "white bile"—a colorless liquid without bile-pigment—in obstructive conditions of the common duct is uniformly associated with an increased surgical risk, approximating 20 per cent. This mortality has not been influenced to any marked extent by more diligent preoperative or postoperative treatment even including blood transfusions before and after operation. Kausch thinks that the hydrops in these cases is due to excessive secretion by the mucosa of the gall-bladder and ducts, whereby, the duodenal opening being occluded, the pressure in the biliary system being so raised that the bile secreted by the liver cells is poured not into the excretory ducts, but back into the blood and lymph-vessels of the liver.[1] Occasionally there is a distinct hydrops and a well-dilated common duct filled with clear mucoid fluid has been observed, and when this rather uncommon condition is seen it is associated with patulous cystic and hepatic ducts and mechanically represents a pressure acholia. Rous and McMaster have shown experimentally that "white bile" occurs only when the obstructed ducts are not connected with a normally functioning gall-bladder, and conclude that this fluid is a secretion of the mucosa of the biliary passages which occurs with obstruction when the secretion of the mucosa of these passages is greater than its absorption.

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[1] Relief of Chronic Obstructive Jaundice by Palliative Operations, John F. Erdmann and Chas. Gordon Heyd, Amer. Jour. Med. Sci., August, 1916.

I can palpate a number of stones, most of them 1 or 2 cm. in diameter. By grasping the right lobe of the liver and making traction gently upward and to the right we can dislocate the liver so that the major portion of the right lobe of the liver rests almost entirely outside of the abdomen. This brings the gall-bladder and cystic duct under tension. We will now proceed to perform a typical cholecystectomy from below up. First, however, we will introduce the first and second fingers of the left hand into the foramen of Winslow and determine the presence or absence of pathologic change in the common duct. This patient is jaundiced and we must determine whether her jaundice is due to intrinsic calculous occlusion of the common duct or due to adjacent or mural inflammation. I find no evidence of calculi in the common duct. The pancreas feels somewhat corrugated, but not definitely pathologic. One must remember, however, that the palpatory diagnosis of pancreatitis is open to serious question, as we may have a pancreas with a "feel" of hardness, and yet have a normal secretory activity both from the point of view of its external secretion into the intestinal tract or in regard to its internal or insular secretion.

We will now proceed with our cholecystectomy. This gall-bladder, so far as function is concerned, is useless and hopelessly beyond any possible restitution to normal. In removing the gall-bladder there are certain well-defined dangers that one must be familiar with in order to safeguard the patient from possible injury to the hepatic and common ducts. There are numerous reported instances in the literature where the common hepatic duct or common duct has been divided or injured in performing an apparently simple cholecystectomy. You will notice that the lowest portion of the gall-bladder, the so-called Hartmann's pouch, hangs down over the cystic duct and is enclosed in a common peritoneal fold with the cystic duct. We will grasp Hartmann's pouch with an artery clamp and make traction upward and to the right. With a curved Mayo scissors we incise the peritoneum over Hartmann's pouch. You will notice that with this dissection Hartmann's pouch swings upward, exposing the cystic duct. You will recall that there is a triangle bounded by the liver, common hepatic duct, and cystic duct which is known as the triangle of Calot, and that ordinarily the cystic artery makes its way across this triangular area to the gall-bladder. Continuing our traction upon Hartmann's pouch we shall pass a curved hemostat through Calot's triangle. After transfixing this space the clamp is opened *in situ* and thereby creates an aperture through which we can safely grasp the cystic duct, with or without the cystic artery (Fig. 173). By this technic any possibility of injury to the hepatic or common ducts

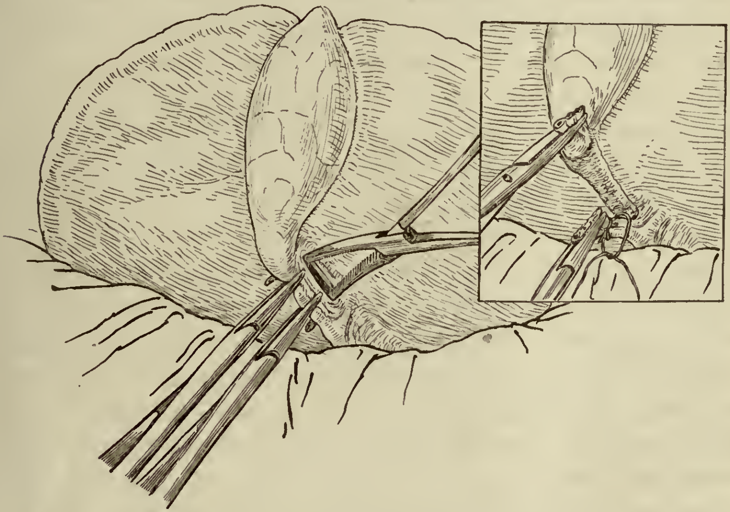

Fig. 173.—The right lobe of liver mobilized and everted, curved hemostat perforating Calot's triangle, with lower blade of clamp holding hepatic and common ducts well back and permitting accurate placing of hemostats on cystic duct.

is avoided. A second clamp is placed above and the cystic duct divided between the two clamps. It is essential to be sure that any calculus in the cystic duct is "milked" back into the gall-bladder before the clamps are applied. Every procedure is carried out by sight. At no time is a clamp inserted blindly or by sense of touch. By means of this precaution we have divided our cystic duct approximately close to its origin and without injury to the adjacent ducts. We will now doubly ligate the cystic duct with No. 2 chromic catgut, the first ligature will be tied below the clamp with the clamp still locked in place. The second ligature will be tied as the clamp is removed. We have therefore a double No. 2 chromic catgut ligature on our cystic duct. The clamp on the divided upper portion of the cystic duct exerts traction upward and to the right (Fig. 173), and the gall-bladder is dissected from its fossa on the under surface of the liver. As we dissect the gall-bladder from the liver we leave a flap of peritoneum on either side so that we shall be able to suture the two peritoneal flaps together and so close in the denuded area of the fossa of the gall-bladder and prevent disabling adhesions. In the dissection upward of the gall-bladder we meet a few blood-vessels which are clamped before division, and finally the remaining tag of gall-bladder is excised from the liver. We now bring the edges of the peritoneal flap together across the area occupied by the gall-bladder with a No. 2 plain catgut, and you will observe we have a completely dry and peritonized surface. A hot laparotomy pad is placed into the gall-bladder wound, and we will now proceed to do a typical appendectomy with inversion of the stump. Finally, we remove the laparotomy pad from the gall-bladder area and a cigarette drain is introduced into Morrison's space—a surgical space represented by the area between the superior pole of the right kidney and the under surface of the liver. The object of this drain is purely prophylactic and is introduced as a precautionary measure in case the ligature on the cystic duct slips off, or to drain the bile-stained discharge that may arise from the cut surface of the liver. We have never felt it either safe or expedient to omit drainage after a cholecystectomy.

Before closing the abdomen we will excise a small piece of liver tissue from both the right and left lobe. It is our purpose to have Dr. MacNeal study these sections and ascertain if we have an interstitial hepatitis and whether it is of the biliary or portal type. We have collected considerable pathologic data on hepatitis derived from operative cases of gall-bladder, gastric and duodenal ulcer, carcinoma of the stomach and appendicitis, as well as autopsy material. We will close the abdominal incision in the typical manner, using plain No. 2 catgut for peritoneum, No. 2 chromic catgut for the fascia, fine silk for the skin, and introducing five figure-of-8 silkworm-gut sutures $1\frac{1}{2}$ inches apart. The cigarette drain is allowed to emerge at the upper angle of the incision.

Postoperative Treatment.—The postoperative treatment of this patient will be that of a peritoneal cavity subjected to both injury and infection. We do not anticipate any infectious process, but we have present, theoretically, the necessary elements for a peritonitis. The patient will be placed in a Gatch bed in the Fowler position with an elevation of head and shoulders to 35 degrees. Nothing will be given by mouth for eight hours and pain will be controlled by 1/5 grain of morphin, repeated in four and eight hours, if necessary. We give morphin postoperatively for restlessness as well as pain. Rest, freedom from pain, and fluids are the essential requirements for recovery. If the patient is without pain, but restless, it is just as serious a menace to her recovery as if she had pain, so our indication for morphin is both pain and restlessness. During the first twenty-four to thirty-six hours we will give this patient by rectum a continuous proctoclysis after the method of Murphy. The solution is made up as follows: tap-water, 1000 c.c.; glucose, 10 per cent.; soda bicarbonate, 2 per cent. At the end of forty-eight hours the cigarette drain will be partially withdrawn and about one-half cut off. At the end of seventy-two hours the remaining portion of the drain will be removed. Enemata will be the rule for three days, then a mild laxative will be given. Soft diet for the first week, then modified regular diet until the patient is discharged.

Epicrisis.—The report from Dr. MacNeal on the pathologic examination of sections from the fundus of the gall-bladder shows extensive loss of the corrugations of the mucous membrane. The entire mucous membrane is very atrophic as a result of chronic inflammation. The muscle bundles are approximately three times the normal thickness and there is an excess of round cells in the interstitial connective tissue of the muscle layer. The outer fibrous coat is thickened to a slight extent. The picture indicates a most marked change in the lining mucous membrane, with hypertrophy of the muscle. Sections of the gall-bladder near the neck show that the muscle layer is also about three times the normal thickness and contains

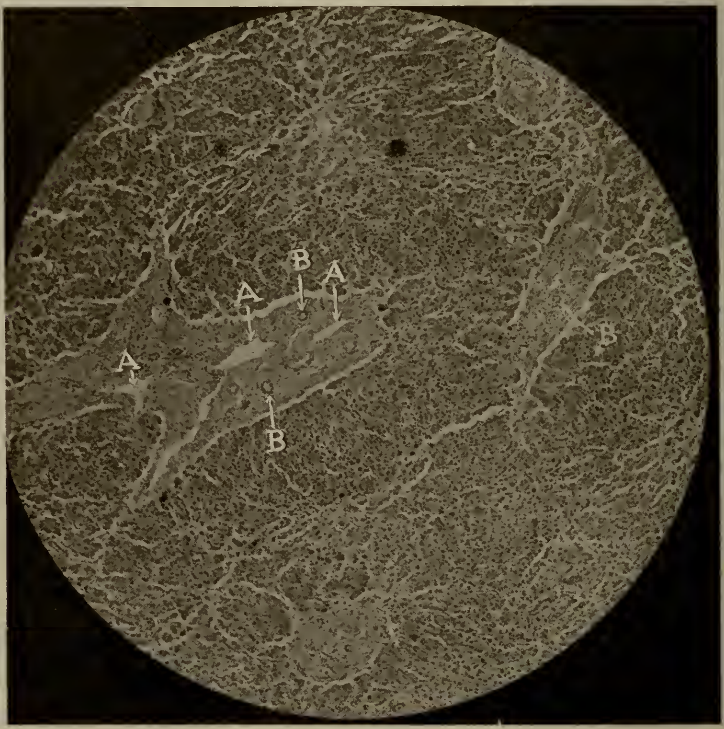

Fig. 174.—Chronic interstitial hepatitis and irregular cirrhosis apparently originating about the bile-ducts: *A*, Portal branches; *B*, bile-ducts.

an excess of round cells in its interstitial connective tissue. The outer fibrous layer of the gall-bladder is moderately thickened in this region and it is diffusely infiltrated with round cells.

Sections of the piece of liver show a moderate increase in connective tissue of the trabeculæ of Glisson's capsule within the substance of the liver. In this connective tissue there are excessive numbers of round cells and in some places conspicuous small bile-ducts, apparently hyperplastic (Fig. 174). The columns of liver cells are well preserved, but among the liver cells there are some very large nuclei. The endothelial cells lining the blood sinuses are somewhat more numerous and more deeply staining than usual, and in these endothelial cells one finds an occasional mitotic division figure. In the sinuses there appears to be also slight excess of round cells and polynuclear leukocytes. The round-cell infiltration in the connective-tissue trabeculæ is rather diffuse, and it is impossible to recognize that it has a closer relation to the bile-ducts than the tributaries of the portal vein. The changes are evidently those of an early cirrhosis. The histologic picture is that of a subacute interstitial hepatitis and early cirrhosis, apparently of more recent origin than the inflammation in the gall-bladder.[1]

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[1] We have recently combined with our pathologic and chemical studies the determination of the alimentary leukocytosis in connection with hepatic function. Whether the Crise Hémoclasique of Widal will be in consonance with our chemical and pathologic studies remains to be determined and will be reported later.

CLINIC OF DR. WALTON MARTIN

St. Luke's Hospital

THE RESULTS OF STAPHYLOCOCCUS INFECTION OF BONE

I have several cases of staphylococcus infection of bone to present. I use the words "staphylococcus infection of bone" rather than "osteomyelitis" because in one of the patients the term "chronic osteomyelitis" might be misleading, as the lesion is apparently of the subperiosteal cortical portion of the bone, and because in discussing these cases I wish to keep the emphasis on the infecting organism.

I wish to call your attention, first, to the lesions caused by organisms of low virulence; second, to the frequency of multiple infections; third, to the significance of the sequestrum, and fourth, to the treatment of cutaneous scars adherent to the bone.

I have here a boy, fourteen years old, with a swelling over the upper portion of his right tibia. The skin over it is normal, it is not red, it does not pit on pressure, the skin moves freely on the underlying tissue. When I press on the swelling it is slightly tender. The swelling is not hard, as if made of bone, but is firm and elastic. He has no temperature, there is a normal leukocyte count, the *x*-ray plate shows, as you see (Fig. 175), a small spot of increased density in the soft part about 2 cm. from the medial condyle of the tibia; evidently a fragment of detached bone. There is no defect or change to be seen in the head of the tibia; the shadow cast by the protrusion of the soft parts is plainly visible.

This boy came to me for a swelling just below his knee about eighteen months ago. It was slightly tender and looked very much as it does today except that the swelling was less marked. I had an *x*-ray photograph taken, and careful examination of the plate showed no area of lessened density or irregularity in the bony outline. I have kept him under observation since then and have had plates made a number of times. Repeated examinations showed that the swelling has slowly grown larger. On one or two occasions he had a temperature of 99½° F.; during these periods he was kept at rest. At the end of twenty-four or forty-eight hours the tenderness was gone and he has been able to go to school, play games, etc.

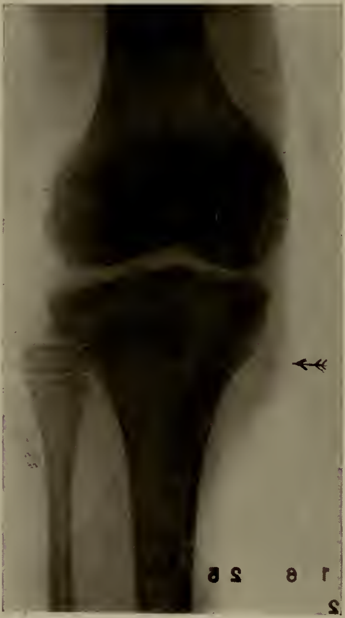

Fig. 175.—Small sequestrum following cortical infection of bone.

Two years and a half ago the boy had a wart on his hand. It was cauterized, became red and tender, and a few drops of pus, I understand, formed under a crust. Two weeks later he noticed pain in the left knee and ankle; he had a chill, followed by a rise of temperature. He was at boarding school, and the attending physician put him to bed, made the diagnosis of acute articular rheumatism, and gave him salicylates. At the end of ten days it was obvious that the lower half of the left leg was red, swollen, and edematous. The bone just above the ankle was extremely tender, and an *x*-ray taken at that time showed a distinct lesion of the lower end of the tibia, close to the epiphyseal cartilage (Fig. 176). The persistent pain just above the ankle-joint, the absence of effusion in the joints, and the history should have made a diagnosis easy even without the *x*-ray plate.

He came under my care at that time. Under general anesthesia the soft parts were divided; there was pus beneath the skin in the cellular tissue. The periosteum was stripped from the medial surface of the bone for nearly the entire length of the tibia. There was a purulent infiltration of the whole lower end of the shaft of the tibia. The cortical bone was removed with a chisel, and the interior of the bone exposed as far as the signs of infection of the marrow extended. The boy made a good recovery; the wound healed and the bone today seems sound.

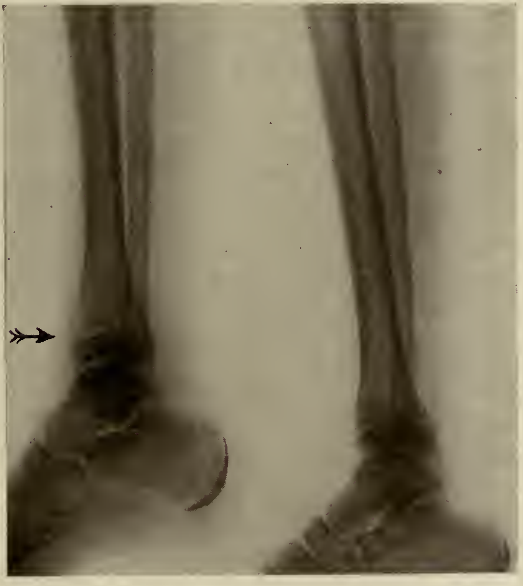

Fig. 176.—Acute osteomyelitis of lower end of tibia.

Now what is the relation between the osteomyelitis two years ago and the swelling in the knee of the opposite side at present? If you question him cloesly he will tell you that he had a little pain in the right knee, from time to time, several months before the swelling appeared. That is, his right knee was tender at the time he was suffering from active osteomyelitis of the opposite leg. The acute osteomyelitis was not the result of a direct invasion of the bone from an overlying infection of the soft parts; there had been no wound or injury to the ankle. It was obviously the usual hematogenous osteomyelitis. Staphylococci entered the blood-stream possibly from the infected wart. These staphylococci must have entered a vein, been carried to the right heart, have passed the capillaries of the lung, and become lodged in one of the small capillaries of the tibia.

If a small number of staphylococci of moderate virulence are introduced into the veins of young rabbits or guinea-pigs, they set up purulent lesions in the osseous system, especially in the metaphyses of long bones, that is, the expanded portion of the shaft of bone near the epiphyseal line. The organisms or clumps of organisms are arrested in the terminal capillaries of intraosseous arteries at these points where conditions are evidently favorable for their growth. If slightly larger numbers of virulent staphylococci are introduced into the veins of a young rabbit there are multiple purulent foci not only in the bones, but in the lung, liver, kidney, joints, etc., and all the transition forms between these two extremes have been observed. Clinical experience is in accord with these experimental findings. One sees patients in which the osteomyelitis is only one of the many purulent lesions found elsewhere in the body, and others in which only a single bone is involved, and in still others two or more bones are involved, the infecting organisms setting up multiple lesions, but these lesions are confined entirely to the osseous system. Moreover, when the organisms are arrested and start to grow they may set up a marked lesion in one place and a very slight one in another. The body cells and the bactericidal properties of the body fluids destroy numerous circulating and lodged staphylococci, a small clump may become established in a capillary and manage to grow very slowly and with little damage to the surrounding tissue, or a large mass of organisms may set up a very progressive and destructive lesion.

This patient has had a typical acute osteomyelitis of the lower end of the left tibia and, I believe, a much less marked lesion of the subperiosteal portion of the bone in the upper end of the opposite tibia, too small to be detected by the *x*-ray plate until the dead bone was detached. The small shadow is a minute bony sequestrum which has become separated. Without the history the swelling might easily have been mistaken for a sarcoma.

Under nitrous oxid anesthesia I am going to remove this sequestrum and, if I am correct in my assumption, I should be able to get positive cultures of staphylococci from the granulations and discharges in the neighborhood of the sequestrum. I do not expect to find pus under tension; there are no signs of inflammation, there has been no rise of temperature. I divide the skin transversely and come down after I have divided the subcutaneous tissues on the swelling. It seems to be covered by the deep fascia and the expansion of the tendon of insertion of the sartorius. This I divide, and expose a mass of soft, reddish granulation tissue. There is no pus or free fluid. In the center of the mass is a small sequestrum, which I remove. It is a typical bony sequestrum with eroded, irregular surface. I take a culture from the center of the granulation tissue. I am not going to scrape out the granulations; I am not going to expose or touch the bone. The process is over, the dead tissue has been separated from the living, the removal of the tiny sequestrum should be sufficient to terminate the process. The staphylococci here have evidently little virulence. The body cells have nearly destroyed them.

From practical experience and experimental work it is generally accepted that when a detached sequestrum is removed entirely prompt recovery follows. The significance of the sequestrum is that it harbors and anchors in the tissue pathogenic micro-organisms. A sterile sequestrum should disappear in the tissues like a bone-graft, but sequestra are not sterile. Kenneth Taylor and others have repeatedly made cultures from them. They were always found swarming with organisms. The effort to sterilize detached sequestra in the body would seem to me to be particularly wrongly headed. There may be places in the body, such as the femur, where the dissection of the soft parts necessary to expose a small sequestrum seems ill advised, and where it is better to open and keep open a sinus leading down to the dead bone for a time, for frequently the sequestrum will become detached and loosened and eaten away, so that it can be easily removed from the sinus. One may be doubtful as to when and how much bony tissue is dead, but there can be no question when the bony tissue is separated and free that it should be removed.

I am now going to put a few horsehair stitches in the skin and put the leg and knee in plaster. If there is no temperature or pain I shall not cut down the plaster of Paris or change the dressing for ten days.

Note.—Cultures taken from the granulations showed Staphylococcus aureus. The wound healed by primary union. There is now no swelling or tenderness over the tibia.

I remember a case reported by Kocher, in which a similar lesion was found. It was mistaken for sarcoma. There was a swelling over the lower epiphysis of the right femur, it was painless, the patient had noticed it for a year, it had steadily but very slowly grown larger. At operation, in a mass of soft granulations, a small sequestrum was found. Cultures taken from the granulation showed Staphylococcus aureus.

I will next show a boy on whom I operated a year and a half ago for osteomyelitis of the tibia. He was then two years old. He had an extensive lesion extending from the upper metaphysis throughout the entire medullary canal. The boy had a high temperature and was very ill. The whole medullary canal was opened. He made a good recovery and left the hospital after six months with the leg soundly healed. He has now a swelling of the right forearm and of the left wrist. These swellings are not tender, he has had no temperature since he left the hospital eight months ago, he is fat and well nourished, and has not complained of pain in his forearm or wrist. These swellings were noticed when he was in the hospital recovering from the operation for osteomyelitis of the tibia. An *x*-ray plate shows a lesion of both arms (Fig. 177). I am keeping the boy under observation; if he has any signs or symptoms of activity in these lesions or if I am able to detect a definite free sequestrum, I shall operate. He has now no signs of infection, nor do I make out as yet a detached sequestrum. Here again there has been a blood-stream infection with staphylococci, producing a well-marked and extensive lesion in one bone, with violent constitutional reaction and slight lesions in other bones, with no constitutional reaction. A considerable clump of staphylococci possibly was arrested in a minute vessel in the tibia, started to grow, destroyed neighboring cells, and was only overcome finally by the body cells after more favorable

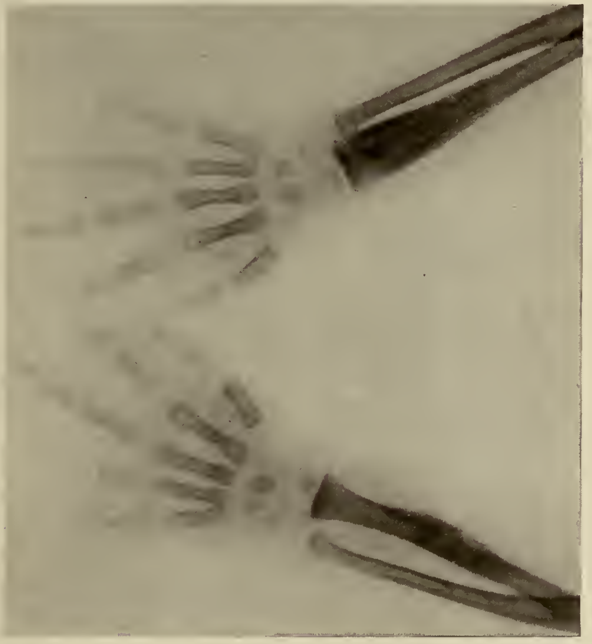

Fig. 177.—Areas of osteomyelitis in right and left forearm.

conditions were created by operation. On the other hand, staphylococci were arrested in the lower end of the left radius and the middle of the superficial portion of the shaft of the right radius, and started to grow, but here conditions were less favorable for their growth. The body cells have weakened the invading micro-organisms and lessened their virulence.

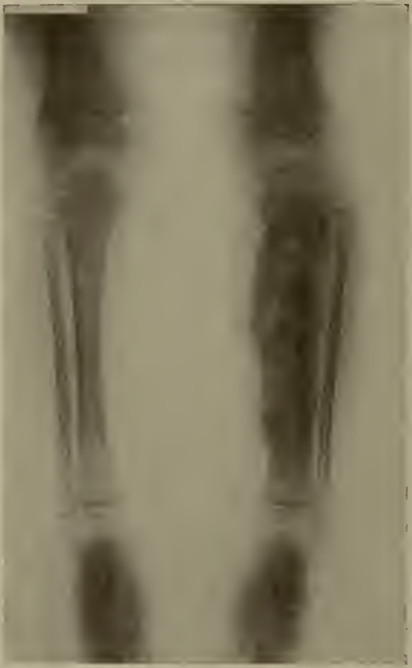

Fig. 178.—Osteomyelitis of tibia showing marked proliferation of bone after operation.

I have here an *x*-ray plate of the tibia taken a month and a half after the operation (Fig. 178). It shows marked proliferation of the newly forming bone. A second plate, taken six months later, shows the same bone soundly healed (Fig. 179). A few scale-like sequestra only were removed during this interval.

I wish now to call your attention to the scars on the legs of both these patients. In the first patient (Fig. 180) the cicatrix is about 15 cm. long and 5 cm. wide. It is depressed in the center and firmly adherent to the underlying bone. At two points there are small dark crusts, evidently dried blood. The surface epithelium is thin and is readily broken and rubbed away by trifling injuries, leaving small abraded areas which bleed. Not only is the surface epithelium thin, but on account of the adhesion to the hard underlying bone and skin is much more readily broken by glancing blows. The skin does not give and move aside on the underlying tissue as normal skin does. This condition is an annoyance to the boy. In playing football and hockey or sliding bases in baseball he frequently injures the skin. The small abrasions heal, but it is a condition that should be remedied. The upper two-thirds of the incision for osteomyelitis of the tibia is well placed. The tibia has, as you know, a subcutaneous medial surface, so that any part of the tibia can be readily exposed. But it is far better to make the incision along the medial margin of this surface of the bone, as in this

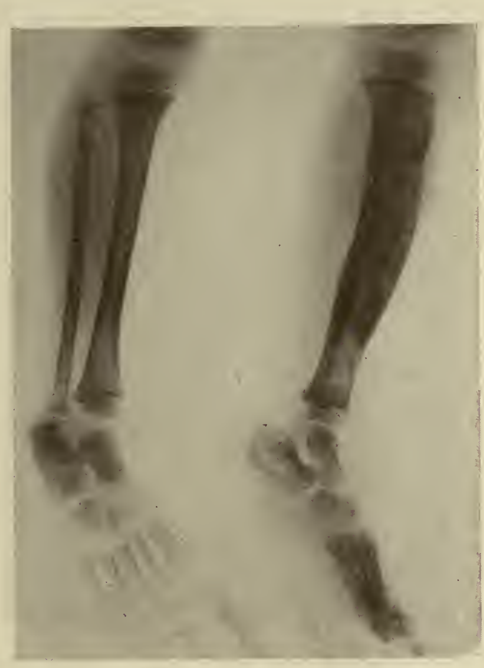

Fig. 179.—Same bone as shown in Fig. 178, six months later.

case, than along the anterior crest. The resulting cicatrix is much less liable to traumatism, but the lower portion of the scar passes over the center of the prominent malleolus where it is most easily injured. It should have been carried in front of or behind the malleolus. In this case there was no need of carrying the incision so far down, as the lesion was above the epiphyseal cartilage.

In the second patient the scar is the same. It is broad, adherent, but in this case it extends the entire length of the tibia. At one point there is bleeding; the mother says the boy injured it today kicking his shin with his boot.

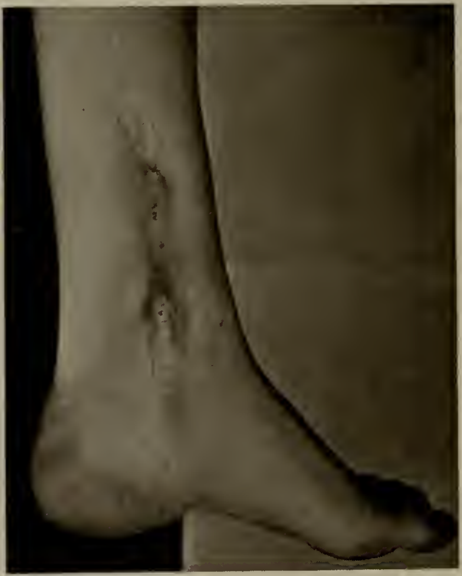

Fig. 180.—Adherent scar following osteomyelitis of tibia.

I am going to operate on both these scars, and I am now going to show the result of such an operation done two years ago for an exactly similar condition. I want to show the result a considerable period after the operation.

This boy came under my care for osteomyelitis of the tibia four years ago. An incision had been made over the medial surface of the upper portion of the tibia and there was a discharging sinus. The *x*-ray showed destruction of the bone along the epiphyseal cartilage, so that there was a solution of continuity in the shaft at this point and involvement of the bone extending half-way down the medullary cavity. The upper half of the bone was exposed, the periosteum incised and separated, and the tibia cut through with a chisel just below the involved portion, and this part of the shaft completely removed. The wound was packed and new bone gradually formed. In six months the leg was soundly healed and the boy was well, but there was a broad adherent cicatrix over the upper half of the tibia which was frequently injured. Two years later this scar was excised, the skin incision passing through normal skin just outside the scar tissue. The cicatrix was made up of dense connective tissue firmly adherent to the bone, which was slightly depressed at this point. This connective tissue was firm and unyielding, and when it was cut away from the bone there were

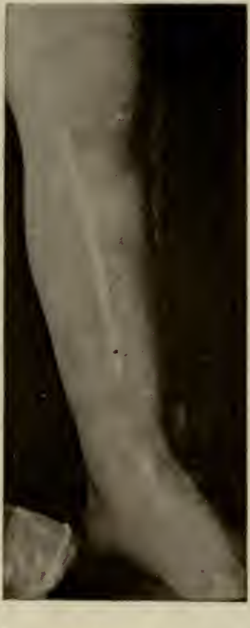

Fig. 181.—Movable scar following excision of adherent cicatrix with transplantation of fat.

numerous small bleeding points. The normal skin on the sides of the cicatrix was then undermined, the undermining being carried on until the skin edges were free enough to be displaced and to come into contact with one another. If they had been directly sutured the skin would have been united over a depressed area in the bone bridging a shallow cavity which would soon have filled up with blood, a condition unfavorable for sound healing; moreover, if union should take place, the contracting scar would again become adherent to the underlying bone.

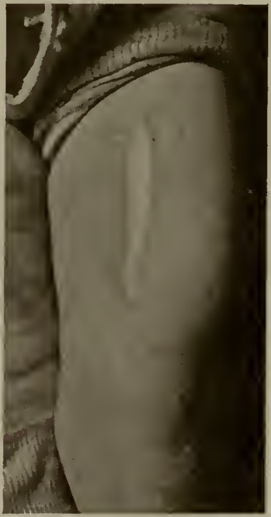

Fig. 182.—Cicatrix following operation for removal of fat from thigh.

The wound was, accordingly, packed with hot compresses, pressure applied to stop oozing, and a second incision made in the anterior surface of the thigh. The little boy was plump and a piece of subcutaneous fat was readily dissected out, somewhat larger than the depression left in the tibia, and transferred to this region. The gauze packing was removed, all bleeding arrested, and the fat placed on bare bone, and the skin united over it by interrupted horsehair stitches. The wound in the thigh was sutured and the leg and knee put up in plaster of Paris. At the end of two weeks the plaster was cut down, the sutures removed, and the leg again immobilized in a plaster bandage. He left the hospital in a month.

I now show you the scar two years after this operation (Fig. 181). It is movable on the deep parts, not sensitive; it is nowhere adherent to the bone. Both scars have stretched to some extent, but, curiously enough, the one on the thigh (Fig. 182), from which the fat was taken, much more than the one united under some tension over the transplanted fat. I do not believe the transplant exists now as fatty tissue; it has probably been replaced by a loose areolar tissue. In any event, it has served its purpose admirably. I took the fat from the front of the thigh because this situation was convenient.

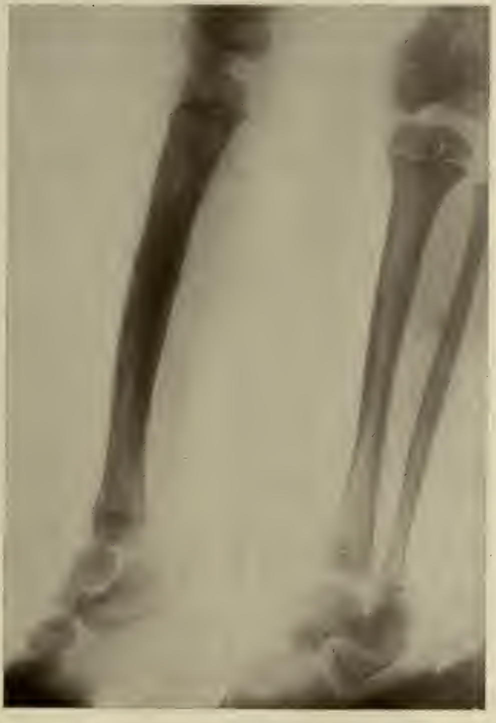

Fig. 183.—New formed bone replacing excised tibia four years after operation.

I show also an *x*-ray plate of the bone (Fig. 183). The half of the tibia removed has been replaced. The leg on the side operated on is now about ½ inch longer than the opposite leg.

We have shown, then, in these cases very different and often multiple lesions produced by the same staphylococci. Some of these lesions are very chronic and are made up of masses of granulations with but trifling damage to the bone itself. We have also called attention to the necessity of inspecting the cicatrix following operations for osteomyelitis and, after a considerable period has elapsed, rectifying by suitable plastic operations adherent and easily traumatized scars.

CLINIC OF DR. EDWIN BEER

Mount Sinai Hospital

TUMORS OF THE BLADDER

During recent years a great deal of interest has been awakened in the diagnosis and treatment of tumors of the bladder. Prior to the last twenty-five years tumors of the bladder were clinically a great rarity, although their actual frequency was recognized by the pathologist since the end of the last century.

Owing to the perfection of the cystoscopic lighting system and the more easily handled cystoscopes, the bladder has been more regularly explored, and cases of tumor of the bladder have been much more frequently recognized clinically. Nowadays patients with the signs of bladder irritation or with hematuria are more regularly given the benefit of a cystoscopic examination, and tumors of the bladder which had previously been treated by internal medication are identified and receive proper care.

Unfortunately, many cases of tumor of the bladder produce symptoms intermittently which tends to lull the patient and his physician into a false sense of security, and if the symptoms of irritation or the bleeding seem to respond to internal therapy, some of these patients, perhaps too many, still fail to have the benefit of modern surgical exploration. If one looks back over one's hospital records for years it is quite astonishing, however, to see how many more patients are nowadays given the benefit of exploration with the cystoscope and proper surgical therapy than were so treated at the beginning of this century.

Pathology.—In this brief summary of the most salient features of bladder tumors involving the diagnosis and treatment an extensive pathologic description is unnecessary. A great variety of tumors are found in the bladder, most of them primary, although secondary tumors, especially from the prostate or by direct extension from the uterus, are not infrequent.

The most common primary tumors of the bladder arise in the epithelial cells of the mucous membrane and present themselves as delicate or more solid papillary tumors, a very delicate structure usually, but at times when the fronds are agglutinated or the pedicle is particularly thick, rather firm looking papillary growths are produced. The bases of such papillary tumors are usually normal bladder mucosa and show no sign of infiltration. On the other hand, the malignant tumors look very much like the benign macroscopically, and are often undoubedly mistaken for benign tumors which probably led such an expert pathologist as Rokitansky to call this whole group of papillary tumors "malignant growths."

Microscopically, however, the two types of papilloma can be distinguished with some accuracy. In the malignant tumors there are marked changes in the nuclei of the epithelial cells, and there is much more irregular growth of these cells, as pointed out by Zuckerkandl some twenty years ago, and more recently by Buerger.

In addition to these two types, there is an infiltrating papillary carcinoma in which the base of the tumor in the bladder wall shows carcinomatous infiltration, and there is also a more solid type of carcinoma without any extensive papillomatous overgrowth, which may be either epithelial in origin, similar to the epithelium of the papillary carcinoma above described, or made up of squamous-cell epithelium looking like typical epithelial dermoid growths.

The adjacent lymphatic glands in the primary tumors which are malignant are involved rather late, the deposits being in the iliac group of glands, and occasionally in some lymphoid tissue which is between the iliac group and the bladder wall, being closer to the bladder than the first group of glands. The favorite site of these papillary growths as well as the more solid growths is about the ureteral orifices and on the base of the bladder, often situated close to the ureter, so that they may press on the ureter, producing hydro-ureter and hydronephrosis of the corresponding side. The benign papillomata much more rarely occlude the ureter, even though a large mass of papilloma surrounds the orifice. Naturally, if secondary infection supervenes in such an occluded ureter and kidney, a pyonephrosis will develop.

A peculiarity of papillomata, both the benign and the malignant, perhaps more characteristic of the former than the latter, is the tendency to produce local implantations in the bladder mucosa, so that at times one sees dozens of tumors of the same type scattered all over the interior of the bladder. The surface of the bladder directly opposite the primary tumor frequently shows the first implant, as if the two surfaces had come together and the seed of the papilloma had been sewn on the opposed surface. This tendency to implant secondary growths is also very frequently seen at the neck of the bladder where innumerable small papillary growths may be implanted about the circumference of the sphincter. Very rarely, strange to say, are secondary papillomata found in the urethra, which is probably due to the fact that they are washed out by the strong current at every emptying of the bladder, so that the implants do not get a chance to take. Papilloma which start in the pelvis of the kidney behave somewhat similarly in that they are liable to produce multiple implants along the ureter and even in the bladder.

In addition to these various epithelial primary growths, there are connective-tissue growths which are much rarer, such as myomata, fibromata, sarcomata, and lymphosarcomata, as well as rare epithelial growths starting in some of the embryonal structures about the urachus.

Symptoms.—The typical symptom of tumor of the bladder is painless hematuria. The hematuria is usually complete, that is, all the urine is mixed with blood and may even contain clots. If the tumor is situated just in the neck of the bladder occasionally the bleeding is terminal. Only after infection of the bladder when cystitis sets in do the patients have marked irritability of the bladder, and with the irritability more or less pain. In neglected cases the pain may be a dominant symptom, although at the beginning of the clinical picture it is most unusual. Frequency varies very markedly. Most patients, however, unless the tumor is large, do not complain of frequency as an initial symptom, though later on, as the tumor gets larger and larger and especially if it involves the neck, and if infection intervenes, frequency and dysuria may be very marked symptoms.

If complications set in, such as occlusion of the ureter, symptoms referable to such occlusion may develop, though in most cases until infection sets in such an occlusion may go uncognized. It must be borne in mind that all patients with tumors of the bladder do not bleed. Some of the largest tumors that I have seen have never produced a hematuria, though according to the history it would seem, in one case, as if the patient had carried the tumor over twenty years, complaining only of some bladder irritation and urgency. Some patients will call attention to the fact that they have noticed flakes of material in their voided specimens which, on analysis, have proved to be broken off fragments of the delicate papillary growths. Others again pass encrusted fragments of tumor which suggest, until carefully studied, the passage of calculi.

Those patients with infiltrating growths that have been neglected, or who have been operated on and have recurrences in the bladder, may suffer terrible agony, having to empty the bladder very frequently and with a great deal of pain, usually associated in each and every act with more or less blood and pus, because at this stage they are almost all infected.

Metatases from malignant tumors of the bladder occur not only in the local glands where local tumors may be felt but also in the skeletal system, in the liver and in the lungs, where they produce symptoms if they attain any size or press on any essential anatomic part.

Diagnosis.—From what has been said in the introductory remarks it is evident that every patient with irritation of the bladder and every patient with painless hematuria should have the benefit of a modern cystoscopic examination.

The technic of cystoscopy has been acquired by so many men that there is no excuse nowadays for neglecting this very essential diagnostic method in interpreting the symptoms referred to.

With the cystoscope in the bladder, unless there is a very active hematuria, the examining eye can readily detect the growth within the bladder, and an experienced cystoscopist can very frequently diagnose whether the tumor is benign or malignant from the cystoscopic picture.

The benign tumors are delicate, fluffy, warty growths of pale pink color, the vessels in the fronds often being visible. The different branches of the tumors float innocently in the irrigation fluid and the underlying mucous membrane of the bladder looks absolutely normal.

On the other hand, the following characteristics are often present in the malignant papillary growths: there is often more or less necrosis of and exudate on the papillary masses, there is also a much more solid union of the fronds so that the tumor looks like a mixture of a papillary and a solid growth, and the underlying and adjacent mucous membrane of the bladder is often edematous and thrown into folds suggesting a blockade or an involvement in the lymph channels of the mucosa and submucosa. It is often difficult, however, to be absolutely sure in the diagnosis between the malignant and the benign papillomata, and it is advisable to excise specimens when in doubt and submit them to microscopic control. Although this control is not absolutely reliable in the great majority of cases it is very helpful.

Another aid in distinguishing between benign and malignant papillomata is the response to the high-frequency treatment; whereas the benign tumors melt away under the current, the malignant papillomata are very much more obstinate, and do not respond to the current by rapidly disappearing. On the other hand, in the more solid tumors in which there are definite nodules where the growth is flat and only moderately raised from the bladder wall, the diagnosis is much more simple, and in these cases one can often arrive at the correct diagnosis without excising a specimen for microscopic study.

Another very valuable aid in deciding the size of the growth and the extent of infiltration in the bladder wall is the cystographic *x*-ray examination made with air insufflation or with bromid. In these pictures the tumor can readily be seen projecting into the bladder if air is used, or as a defect in the filling if bromid is used to make the picture. Although these latter methods are very helpful and should be employed whenever in doubt, they are not regularly reliable, as I have been repeatedly fooled by defects, in patients who could not be recystoscoped, and concluded from the cystogram that the tumor was situated not only where I had seen it at the first cystoscopy, but that there was an extension to another part of the bladder which at operation proved to be uninvolved. In deciding the amount of infiltration of the bladder wall the cystogram may show marked deformity owing to the infiltration of the various walls of the bladder.

Another valuable sign is the vaginal or rectal examination, which should regularly be made in all doubtful cases, and the examining finger may detect very readily the increased resistance corresponding to the area of the bladder wall that is infiltrated by the malignant growth.

Treatment.—In discussing the treatment of bladder tumors one naturally limits oneself to the primary and common types of tumor, namely, the papilloma, the papillary carcinoma, and the infiltrating carcinomata. Until some twenty years ago these tumors had been regularly either left alone as noli-me-tangeres or operated on either by the transperitoneal or extraperitoneal suprapubic route. The results of the operative treatment were so unsatisfactory that some surgeons went so far as to recommend a deflection of the urinary stream by double nephrostomy so as to put the bladder at rest and give the patient some comfort, leaving the original tumors or tumor in the bladder alone.

As recurrence following the open operation was the regular sequence of events, the profession was thrilled when Nitze published his series of bladder tumors treated with his operating cystoscope transurethrally. There can be no doubt that this series of well-observed cases indicated the direction of future development, but owing to the intricacy of the cystoscopic mechanism and the difficulty of acquiring the necessary technic, it was impossible for the profession as a whole to employ the transurethral method developed by Nitze. Some new and simpler transurethal procedure had to be evolved, and for many years those of us who were interested keenly in this problem turned our minds to simplifying the transurethral methods. Blum of Vienna originated simple snares and forceps which could be introduced through the ordinary catheterization cystoscope. Casper and Kuttner produced rather elaborate instruments similar to Nitze's operating cystoscope, but all of these attempts, including Young's rongeur, failed to solve the problem. In 1910, after considerable experimental work with the high-frequency currents of Oudin and D'Arsonval, it was found that with a properly insulated electrode of 6 Fr. caliber the current could be brought in contact through the cystoscope with benign tumors of the bladder, and quickly, by virtue of its cauterizing and perhaps ionization effect, destroy the neoplasm. This simple technic which any cystoscopist could readily master really made for revolutionary changes in the whole problem.

Since 1910 many thousands of cases of benign tumor have been treated successfully by the high-frequency currents. In my experience the Oudin current has been more satisfactory than the D'Arsonval or bipolar current, though of late years it has been impossible in America to obtain an electrode adequately insulated to carry the monopolar or Oudin current. Since a year and a half these electrodes have been manufactured abroad for me by a Swiss firm, and are so efficient that in my work I rarely have to make use of the bipolar current and the electrodes which have been manufactured for me in Germany and America.

In a rather extensive analysis published in 1915 I called attention to the most striking differences between monopolar and bipolar currents. If it were possible to apply the bipolar current to a papillary growth which could be raised from the bladder wall at the same time as the current was run through it, it is perfectly conceivable that owing to the distant effect in the pedicle the pedicle might be cauterized and the blood-supply of the whole growth destroyed at the very first sitting. But as yet it has been impossible to construct an instrument which will at the same time raise the growth from the bladder wall and allow the current to run through the same instrument that raises the growth. The distant action of the bipolar current renders it less controllable than the monopolar current. Moreover, the explosive force of the monopolar current breaks off pieces of the growth rapidly, while the operator is cauterizing the papilloma. The response following treatment with the high-frequency currents is very striking. Gas is generated as soon as the current is turned on and the fronds of the tumor are blanched. Subsequently at the point of contact the tumor is seen to be carbonized. The gas that is generated appears to be hydrogen, and every once in a while small collections of this gas in the anterior wall of the bladder, provided the tumor is in the vicinity of the gas-bubble, can be heard to explode within the patient's bladder. The same gas is generated when a piece of meat under water is treated with the high-frequency current. Originally it was thought by some, though never believed by me personally, that the high-frequency treatment might be used in carcinomata. I have always avoided its use in frank malignancies except as a hemostatic agent, though I was always ready to admit that very early malignant changes in tumors that looked frankly papillomatous might be successfully treated with the high-frequency current. Although the high-frequency cauterization has undoubtedly had great success and has simplified the treatment of benign papillomata of the bladder, still there are very definite contraindications to its use, which contraindications are not thoroughly appreciated by the profession as a whole. Everywhere one sees numerous cases that have been repeatedly cauterized with this current who were not fit cases for this type of therapy. Such attempts to continue in the use of the high-frequency current when one is not getting the proper responses are liable to bring the method into disregard.

For many years I have taken the attitude that all malignant tumors should be excluded from the high-frequency treatment as well as all papillary growths that do not respond in the typical manner after one or two treatments. Moreover, extensive tumors at the neck, even though they be benign, should not be treated with the high-frequency current, as it is almost impossible for the operator to make careful, systematic applications of the current at the neck of the bladder. A fourth group that should be excluded from this treatment are those cases which bleed profusely at each introduction of the cystoscope, and therefore cannot be properly visualized. In addition, patients who are intolerant to cystoscopy naturally should not be so treated unless the operator is willing to use a general anesthetic, which may be a dangerous procedure in view of the fact that the patient's co-operation is so essential in deciding how far one may push the electrode in treating the growth. Whereas the patients complain of no pain while the tumor is being treated, provided the electrode touches only the tumor, as soon as the normal bladder wall is struck by the electrode the patient complains of pain which guides the operator, and which guide would be lost under general anesthesia.

It is also a question whether patients with very extensive papillomatosis of the bladder should be treated in this way. Having tried the method on such cases I have come to the conclusion that with our improved cautery technic through a suprapubic incision one gets more satisfactory permanent results more quickly than by the transurethral method. If we exclude, therefore, all the above cases from the transurethral method the surgical removal of the growths in these cases must be employed.

As said above, experience in the past has shown that surgery has been followed by recurrence in the great majority of cases. The reason for the recurrences, it seems to me, is quite evident. Even benign papillomata when operated upon by the older suprapubic methods regularly recurred because of the inherent property of these epithelial cells to grow on denuded or wounded surfaces. Therefore, in trying to improve upon the old method of operating, the modern surgeon must develop a method which prevents any implants, he must attempt to destroy the tumor *in situ* with a cautery, he must sponge as little as possible, he must operate on an empty bladder so that the wound is not flooded with an emulsion of tumor cells as soon as the suprapubic incision reaches the bladder cavity, and he must protect the perivesical space and the wound in the adbominal wall so that no accidental implants may result.

During recent years many improvements have been introduced into the surgical technic of the removal of bladder tumors, and perhaps the most important step has been the extraperitoneal liberation of the bladder which allows the surgeon to draw the organ well out of its peritoneal and perivesical coverings, so that when the bladder is opened it is practically two-thirds out of the abdomen. This method of approach has been favored by most recent writers, including Squire, Voelker, Latzko, and myself, after having given the transperitoneal approach a fair trial. The mortality in the transperitoneal approach is much higher than in the extraperitoneal approach, and in the former it is impossible to mobilize the bladder in such a way as to prevent contaminating the wound with tumor-cells.

The operative removal of tumors in the bladder, whether they be benign papillomata, papillomatosis, malignant papillomata, or infiltrating papillary carcinomata, should be along the following lines:

The bladder should be washed out gently prior to operation, and after the organ has been emptied completely the patient placed in the Trendelenburg position. A long median suprapubic incision is made down to the bladder, which is not opened. The bladder is then separated from its peritoneum, the dissection being begun at the apex and the urachus being liberated. The latter is doubly clamped and cut, the upper stump is ligated, and the lower end, attached to the apex, is used with its attached clamp to draw the bladder toward the symphysis while the operator separates the peritoneum from the posterior wall of the bladder. If the tumor is known to be on this surface of the bladder, it is well to excise the overlying peritoneum and immediately close the opening made in the peritoneum. After completing the dissection well down to the ureters, a few branches of the vesicular vessels being tied on either side, the bladder is drawn further and further out of its perivesicular bed, and being held in this position by an assistant, the wound, kept open with a

Balfour self-retaining retractor, is thoroughly protected with heavy gauze pads to prevent contamination. Then the bladder is incised either on its posterior, anterior, or lateral walls, depending upon the site of the tumors or tumor. As soon as the bladder is opened any fluid which might have accumulated during the above steps of the operation or might have been left behind by incomplete evacuation through the catheter is disposed of either by gentle sponging or by suction apparatus. As the incision in the bladder is enlarged, the growth or growths become visible, and with the electric cautery they should be completely destroyed *in situ* with as little sponging as possible. If the tumor is a benign papilloma or multiple papillomata, corresponding to the papillomatosis cases as mentioned above, the complete destruction with the cautery of the well-exposed tumor or tumors well into the bladder wall, without resection of the underlying wall, will suffice. If, however, the cystoscopic and the preoperative microscopic examination and the palpation at the time of exposure of the bladder suggest a malignancy, the underlying bladder wall must be widely excised, preferably with a cautery knife. The palpation of the bladder wall from without is the most valuable aid in deciding the extent of the malignant infiltration underlying the bladder tumor.

In case the tumor involves a ureter orifice and has obstructed same, it is well to make a cautery resection of the tumor with the ureter attached and subsequently having drawn a ligature around the ureter, cut off the tumor from the ureter by section of the ureter 2 cm. from the bladder. In such cases the ureter must be reanastomosed with the bladder by the simplest technic available, which consists of puncturing a healthy part of the bladder wall and drawing the ureter through after splitting it into two lips and attaching same on the inner and outer surface of the resected bladder, with a couple of chromic stitches. Having either destroyed the tumor *in situ* or having destroyed it and resected the bladder that is involved in case of malignancies, it is recommended to burn the incision in the bladder wall with the cautery, removing the Carmalt clamps which have been placed upon the edge of the bladder opening during the operation. By cauterizing this whole edge of the incision all implants which might accidentally have been made will be destroyed, and as no perforations of the bladder wall have been made by using tooth clamps—for example, Ochsner type—there will be no danger of producing deep implants close to the edge of the incision. Having cauterized the whole incision, all the Carmalt clamps should be removed and the bladder allowed to drop back into the pelvis, the table lowered, and the wound filled with strong alcohol for five minutes, with the object of coagulating any viable tumor-cells which might have been broken off.[1]

Having sponged out the alcohol, the position of the table is again changed and the charred bladder incision is closed with a running suture of plain catgut which goes through all the walls, and an external suture of chromic gut. When this closure is well under way, the tied-off ureter, in cases of ureter reimplantation, is brought in to some healthy part of the bladder and attached. The whole of the bladder incision is closed, leaving an opening for suprapubic drainage. A rubber-dam is placed on either side of the bladder and brought out through the suprapubic incision alongside of the tube, and the abdominal wall is closed in layers.

Since adopting this technic some five or six years ago and carrying out every step with meticulous care, the immediate as well as the end-results have been markedly improved. The mortality is somewhere around 5 per cent., whereas the mortality in the transperitoneal operation was more than twice that. Moreover, with this method of operating one has perfect control over possible implants which might be broken off from the original tumor, which one would not have with the transperitoneal operation.

It must be evident to anyone working in these lines that a method of operating that is successful in benign papillomata, which cannot be treated transurethrally, and in papillomatosis cases, meets the indications of an operation. This is really more of a test of the adequacy of an operative procedure than would be the results obtained in infiltrating growths where the operator cannot be sure of the extent of bladder wall involvement at the time of operation.

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[1] This technic has been fully described with illustrations in the Annals of Surgery, January, 1921.

Radium Therapy.—Having discussed the transurethral and the operative methods, we come to a very mooted field, namely, the field of radium therapy. There can be no doubt from published reports that radium is a most useful agent in the destruction of tumors of the bladder. Whether it should be restricted in its use to definite inoperable cases or whether it should be used indiscriminately in all cases malign and benign seems very difficult to decide at the present time. There is a very definite group of tumors of the bladder in which the malignant growth is situated at the neck and for which surgery can offer nothing but a complete removal of bladder, prostate, and seminal vessels. In malignant growths situated in this position it is possible that radium may offer a great deal, and surely in this type of inoperable case the use of radium is definitely indicated.

On the other hand, tumors that are definitely removable by operation, it seems to me, should still have the chance of cure that surgery offers, as the radium treatment must of necessity be a hit-or-miss procedure in view of the fact that the operator who introduces the emanation needles either transurethrally or through an opening in the bladder made by suprapubic incision does not know at the time of the introduction of his needles how wide an area should be radiated or how deeply the needle should be embedded. On the other hand, by such an operation, as outlined above, the surgeon feels the extent of the infiltration and can go as wide of it in his cautery resection as indicated.

It has been claimed by some that preoperative radiation or combined radium and high-frequency treatment give very satisfactory results. With this personally I have had no experience, though I have noted that bladder tumor cases that have been treated with the deep *x*-ray seem to respond more rapidly to the transurethral high-frequency treatment. Experience along these lines, however, is so limited as yet that conclusions cannot be drawn.

Another interesting point in connection with the treatment of bladder tumors by radiation was brought to my notice some years ago in a patient who refused operation and submitted for months to transrectal and transabdominal radiation. Finally when he came to operation he presented such an extensive growth that it seemed useless to attempt a cautery resection. Nevertheless, rather than do a cystectomy, a very extensive resection was done, and the patient, much to my surprise, has remained well and free from recurrence for over three years. In this case, under all the rules of the game, one would have expected this patient to succumb with a recurrence long ago, and one cannot help but feel inclined to attribute part of the good result to the extensive preoperative radiation. It might well be worth while giving all patients before bladder resections a course in deep *x*-ray therapy which will delay the operation only a short time, making the operation somewhat more difficult on account of adhesions, but perhaps improving the end-results.

End-results.—In the transurethral treatment of bladder tumors with a high-frequency current the great majority can be cured definitely by this treatment. These patients must be controlled regularly and should be seen while under treatment every two weeks until the growth is destroyed, and then regularly every three months for a period of one year. If throughout this year's period there is no evidence of recurrence the chances are that the patient is permanently cured. My original cases so followed for years have remained absolutely well. The benign tumors which cannot be treated transurethrally and the papillomatosis cases with the operative technic outlined above are cured with great regularity, so that the old idea of a papillomatous dispostion is gradually being given up by me.

As far as the papillary carcinomatous tumors are concerned, the above cautery operation with resection of the base has given me a large number of permanent cures. In the infiltrating solid tumor of the bladder wall, perhaps especially in the squamous-cell tumors, the results are much less satisfactory despite careful adherence to the technic above described. In these cases I doubt very much whether one-third of the patients are permanently cured, and I believe the reason that these patients get recurrences is that the surgeon at the time of operation fails to remove all the tumor by virtue of the fact that it is impossible to determine how extensively the tumor has infiltrated the lymphatic channels.

There is also another point in connection with this whole problem that in closing should be emphasized. It is not generally appreciated that there is a marked biologic difference between malignant tumors. To those of us who see a large number of malignancies in the bladder and prostate, it is very evident that tumors that macroscopically and microscopically are indistinguishable behave very differently. Some remain localized for a long time and produce no metastases, whereas others grow like wildfire and produce either metastases or death. The very fact that tumors of the same constitution and appearance vary so in their biologic activities makes it particularly difficult to arrive at a satisfactory conclusion as to which is the proper method of treatment as based on published end-results.

CLINIC OF DR. CLARENCE A. McWILLIAMS

Skin and Cancer Hospital

TRUE PANCREATIC CYST

I bring this patient before you today to illustrate nature's wonderful curative powers when aided by helpful surgical assistance. She is now sixty-two years of age, with considerable adipose development, and the mother of 4 children. She first came into my hands in the Presbyterian Hospital in October, 1910, complaining of pain in the left upper abdomen. The first attack of pain dated back fourteen years. It was of a sudden, tearing, severe character radiating upward to both shoulders, starting at the left upper quadrant of abdomen, lasting for about an hour without any cessation. These attacks came on at intervals of six months, had no reference to meals, and would come at different times in the day. After the attacks, would belch a great deal of gas. Never vomited during these fourteen years, nor was jaundiced, nor spat up any blood. Five weeks before admission the patient had an attack which lasted all night. The pain in the left upper quadrant was very severe and constant and there was a great deal of vomiting. Patient had to have morphin. Ever since then there has been a dull aching pain in the left upper quadrant which is only relieved by pressure or lying on that side. The pain has gradually gotten better and the vomiting also. Has become thin and lost a great deal of flesh. Examination on admission showed heart and lungs normal. In the upper abdomen, 4 inches below the ensiform, there is a large transverse, indistinct, soft mass, not nodular, but smooth and only slightly tender. On percussion over this mass there is dulness. Ewald's test breakfast gave 90 c.c. watery fluid with no mucus and with very little food. Total acidity 6 c.c., or .021 per cent.; free hydrochloric acid 2 c.c., or .007 per cent. Test of feces showed only slight mucus, slightly acid, marked reaction for urobilin, faint reaction for blood. Microscopically, no pus or red blood-cells, and no excess of fat.

A positive diagnosis could not be made, but in view of the attacks of pain with the indistinct, high, abdominal mass, an exploratory laparatomy was undertaken on October 28, 1910. Gas and ether were administered and a vertical incision was made through the inner third of the upper right rectus. There was no free fluid in the abdomen, nor were there any adhesions between the anterior abdominal wall and the underlying viscera. The gall-bladder was normal. On inserting the hand there was felt a large, soft, smooth, fluctuating mass, the size of a large grapefruit, extending over to right of midline and to left under the spleen and above high up to the diaphragm. There was no doubt that it was a non-pulsating collection of fluid, so a syringe was inserted, after padding off the intestines below, obtaining chocolate-colored, odorless, turbid fluid. The needle was inserted through the gastrohepatic omentum. After withdrawal of the needle the wall of the cyst was drawn up to the abdominal opening and a trocar and cannula were inserted, evacuating over a quart of fluid. A large rubber drainage-tube was sewn in by a purse-string suture and the cyst wall was sutured to the abdominal wall. Culture of the cyst gave Staphylococcus albus (contamination?). Examination of the fluid from the cyst showed it to be a thick fluid of faintly greenish-yellow color, of faintly alkaline reaction, with a specific gravity of 1022. Fat-splitting ferment was markedly present and also a decided trypsin reaction, with the presence also of diastasis ferment. The convalescence was smooth and in twenty-four hours about 8 ounces drained through the tube into a drainage bottle. From these findings it was evident that we had to deal with a true pancreatic cyst whose etiology was unknown? There had been no previous abdominal trauma at any time. The drainage-tube was gradually forced out, and was left out permanently four months after the first operation.

She was readmitted in September, 1911, complaining of continuous severe pain in the epigastrium. where there was felt an indistinct tumefaction. It seemed probable that the cyst had filled up again. So at exploration on September 15, 1911, an enormous cystic mass was felt behind the stomach, to which it was tightly adherent. An opening was made through the gastrocolic omentum and the cyst wall was held to the abdominal wall and a very large amount of chocolate-colored fluid was evacuated. The finger inserted went into an enormous cavity extending over to the right in front of the vena cava and above to the diaphragm. A small section of the wall was excised. Excision of the whole sac was deemed absolutely impossible because of its firm adherence to all the important surrounding structures. The cavity was swabbed out with iodin solution, three strips of gauze were packed to its bottom, and a drainage-tube was inserted. The opening in the cyst was sutured to the abdominal wound edges.

For the next seven years she dressed the wound herself, wearing all the time the drainage-tube. In May, 1918 she was readmitted, complaining of the same colicky pains as previously. The drainage-tube was about 3 inches long, emitting a small amount of discharge each day. Five days before the last admission there was a sudden increase in the discharge from the sinus, which became greenish yellow, macerating the skin, prior to which the discharge had been colorless and did not irritate the skin. The previous day she passed from the sinus a peanut she had eaten the day before.

Examination of the discharge showed the presence of pancreatic ferments. The ingestion of carmin by the mouth was followed by its appearance from the sinus. Three months later, in July, 1918, she was readmitted because of severe, colicky, epigastric pains. The discharge from the sinus became yellowish, looking like bile, and examination of the discharge gave a marked bile reaction with rapid digestion of protein and starch. Bismuth injected into the cyst through a catheter was seen through the fluoroscope to mingle with bismuth ingested by mouth. For these reasons it was thought that the cyst wall had perforated into the alimentary canal, probably the duodenum, caused by pressure of the drainage-tube. No operative procedure was deemed advisable. In March, 1919 she was readmitted because of epigastric pain. There was very little discharge from the sinus and the tube had been discontinued. There was much indigestion. A diagnosis of chronic cholecystitis was made, but operation was refused. In three months (July, 1919) the sinus healed completely and has not reopened since.

In February, 1920 she was suddenly seized with agonizing, colicky, epigastric pain with fever and was taken in an ambulance to the Patterson Hospital, New Jersey, where Dr. Maclay removed a gall-bladder which contained fifty-four stones. He saw no evidence of the pancreatic cyst save adhesions; presumably it had become obliterated through adhesion of its walls. She is now well save for some slight indigestion. There are no herniæ present in the abdominal wall.

The etiology of such a cyst is unknown. It is conceivable that a hemorrhage might have occurred in the substance of the pancreas and not have been absorbed. This blood might have so irritated the walls of the cyst that it continued to secrete, absorption of the fluid being less than secretion, causing the cyst to gradually enlarge. But what caused a hemorrhage in such a deep-seated and protected organ as the pancreas? Pancreatic cysts are more uncertain in their etiology than hemorrhagic pancreatitis, for we know that this latter is due to infection at least. Marsupialization is the only possible treatment in such a cyst, combined with vigorous scrubbing to remove its lining cells and the subsequent applications of pure iodin.

CLINIC OF DR. MORRIS K. SMITH

St. Luke's Hospital

FRACTURE CLINIC[1]

UNRECOGNIZED FRACTURE

The first patient I want to show you today is J. M. He came to the clinic when fifteen years of age complaining of injury to his left elbow. The story was that while wrestling four days before he fell on the elbow, since when it had been disabled. Examination showed moderate swelling, limitation of motion, and well-defined tenderness over the inner condyle. A radiograph (Fig. 184) was made. There are no evidences of fracture in it, as you can see. This was somewhat of a surprise in view of the definite localized tenderness; however, a diagnosis of contusion was given, and we felt that a prompt recovery could be anticipated.

The boy returned two or three times and then dropped out of sight until about six weeks after the injury, when his father brought him back, stating that the elbow was not getting better as he had expected.. Motion was still very limited. Another *x*-ray was taken, which shows the condition you see in Fig. 185. If you compare the injured elbow with the uninjured and with both in Fig. 184 you observe that the internal epicondyle is in two fragments. Let me quote from the report of the radiologist, Dr. LeWald, "There is production of new bone or calcification about the inner condyle of the left humerus. This confirms the probability of there having been an epiphyseal fracture involving the center of ossification for the epicondyle."

In commenting on the first radiograph Dr. LeWald had said that an epiphyseal injury could not be ruled out. That comment we had failed to take into account. The lesson I want to impress upon you is that an early negative radiograph does not definitely rule out fracture. This case is an illustration as regards epiphyseal injury. Occasionally in adult bones the deposition of callus is the first *x*-ray evidence of slight fracture.

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[1] Service of Dr. H. H. M. Lyle and Dr. F. S. Mathews, St. Luke's Hospital, New York.

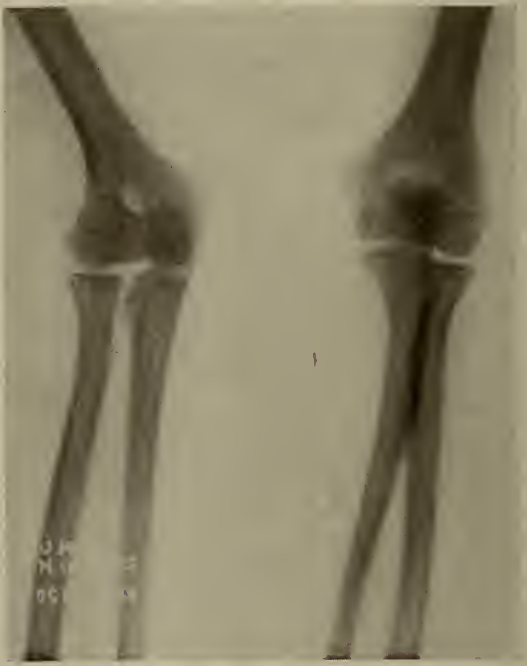

Fig. 184.—The arm on the left, as one looks at the radiograph, is the injured one. There is no evidence of fracture.

I would remind you too that occasionally extensive fracture is not seen in one exposure when quite apparent in another, so that both anteroposterior and lateral views should be made in all suspected cases. An illustration of this very much in point was a small boy seen during the infantile paralysis epidemic, with the history that for several days he had not moved his left leg. There was a story of a fall from the curb as the initial event. On examination the child did not appear in pain, and there was no notable swelling or discoloration. He would make no effort to move the leg. An *x*-ray (in one plane) was negative. The diagnosis of anterior poliomyelitis therefore seemed most probably the correct one, and the child only escaped being hospitalized as such by a second *x*-ray study, which in a different exposure showed a long oblique fracture of the tibia without displacement.

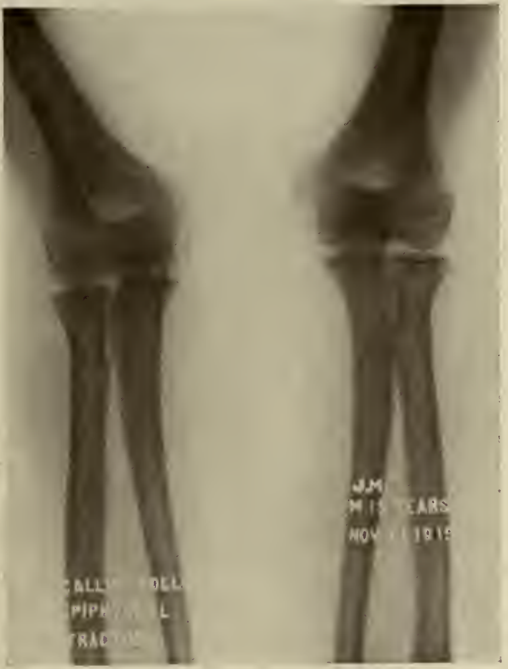

Fig. 185.—Same as Fig. 184 six weeks after injury. The internal epicondyle on the injured side (to the left) is apparently in two fragments. This only became apparent radiographically after new bone production.

You see that J. M. has perfect function and has suffered no harm because the condition was originally unrecognized. However, we should have been suspicious on account of the very definite localized tenderness, a good illustration of the fact which we are prone to forget that the *x*-ray supplements but does not take the place of clinical diagnosis. Had we guarded our diagnosis properly when we first saw the patient the parents would have been spared the anxiety of the boy's failure to get well in the expected time, and we the embarrassment of having finally to reverse our diagnosis. That there are possibilities of unpleasant legal complications in such a situation you can easily imagine.

SEPARATION OF LOWER RADIAL EPIPHYSIS

The next patient is R. R., who came to the clinic one and a half years ago with an injury of the right wrist. He was thirteen years old at that time. I want you to examine him before we proceed with an account of his case. You observe that function of the right wrist has suffered in no way, his motion being equal on both sides. There is likewise no deformity remaining. I do not believe you could tell from examination which wrist had been injured.

Two weeks before applying for treatment he had fallen on the hand. There was a marked silver-fork deformity. There had not been a great deal of pain and he could use the hand quite well. The silver-fork deformity is characteristic of Colles' fracture in adults, in young people it is usually due to a backward separation of the lower radial epiphysis, often carrying some fragments of diaphysis with it. Figure 186, the radiograph made at the time, shows this latter to have been the condition. You observe that the displacement of the epiphysis was considerable. In view of this deformity and the fear that it would be more or less permanent, with limitation of flexion, we decided that an attempt to reduce the separation under anesthesia should be made in spite of the time that had elapsed since the injury occurred. This was done, using a Thomas wrench, a very powerful and useful instrument in fracture work. There was, however, no improvement in position. You have seen the clinical result. Figure 187 is a recent *x*-ray. You observe that the epiphysis is back where it should be and that the evidence of the previous injury is slight.

M. K. is a case like R. R. She was eight years of age when she came to the clinic with a backward displacement of the lower radial epiphysis, which you see in Fig. 188. The injury occurred

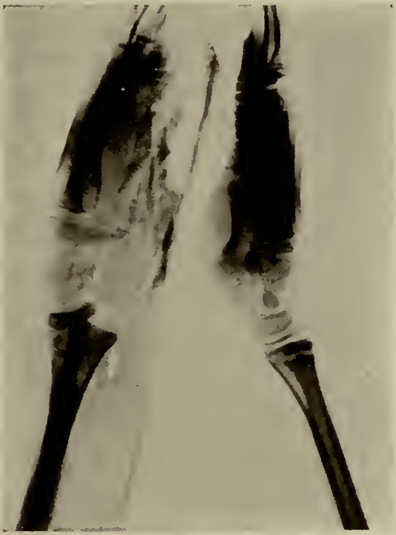

Fig. 186.—Separation of lower radial epiphysis with considerable backward displacement. At the time this *x*-ray was made, two weeks after injury, attempted reduction failed.

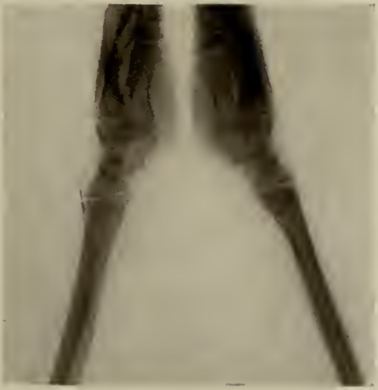

Fig. 187.—Same as Fig. 186. Eighteen months later. Nature has almost completely corrected the deformity.

three weeks before, when she was in the country. It did not cause much pain and she would use the wrist fairly well when examined, but her mother was troubled by the deformity which became apparent as the swelling subsided and which was very noticeable. Incidentally you see from the scars on the patient's arm and from the radiograph that she had previously had an osteomyelitis of the ulna on that side.

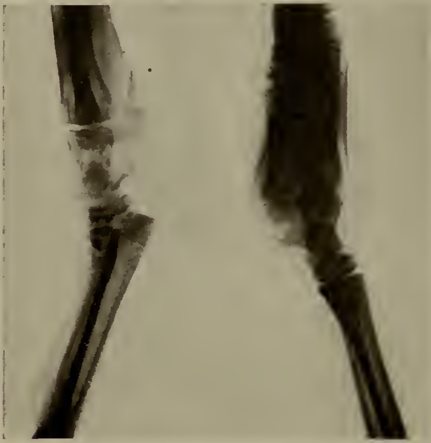

Fig. 188.—Separation of lower radial epiphysis with backward displacement three weeks after injury. Attempted reduction failed.

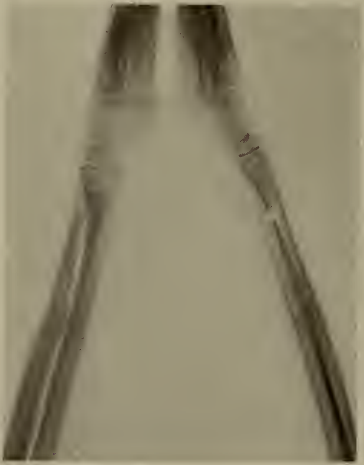

Fig. 189.—Same as Fig. 188. Five months later.

Not having had at the time we saw M. K. the benefit of knowing the late result on R. R., we attempted, as we had in R. R.'s case, a reduction under anesthesia on account of the deformity. It was likewise unsuccessful.

Figure 189 shows a radiograph made five months later. The correction is striking, and, as you see from examining her wrists, the result is as satisfactory as if we had received this patient early enough originally to reduce the displacement.

These 2 patients have made me feel that one should not attempt extreme measures to get a satisfactory reduction on a separated lower radial epiphysis. I do not advocate a policy of non-interference if it is possible to do a reduction, because the principle of restoring normal relations as nearly as practicable in the treatment of fractures is correct, but if a case comes late, so reduction by manipulation is doubtful or impossible, a good anatomic and functional end-result may apparently be anticipated, and certainly an open operative procedure would seem unwise.

In judging of epiphyseal separations the possibility of premature ossification with consequent shortening and deformity must be considered. Whether it is more likely to occur in unreduced partial separations such as these patients represent than when a good reduction has been accomplished I do not know. In the only patient I have had where premature ossification occurred at the lower radial epiphysis there was a fair reduction.

Another question of interest which this subject brings up is that of how soon nature will accomplish her anatomic restoration. M. K. was a five months' result. R. R. you saw at the end of eighteen months, but he was examined in nine, and found to be all right.

Is the lesson of nature's corrective powers in displacement of the lower radial epiphysis equally applicable to other separated epiphyses? I have seen excellent results in similar cases at the upper humeral epiphysis, not quite as perfect radiographically, but leaving nothing to be desired practically. I have not had comparable cases of other epiphyseal separation.

Truesdell[1] has shown that nature can completely repair unreduced separated epiphyses occurring as the result of birth injuries.

TREATMENT OF FRACTURES OF NECK AND SHAFT OF HUMERUS

The next 3 cases I have to show you illustrate a method of treatment of fractures of the neck and shaft of the humerus which is described in the standard treatises on fractures, but has not received the attention or emphasis it merits.

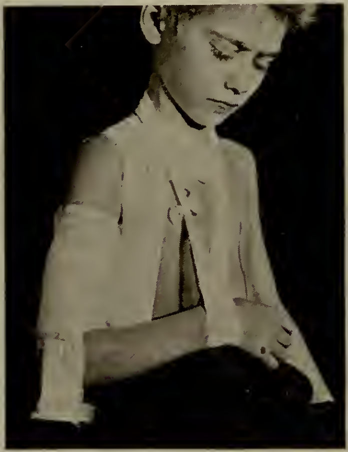

Fig. 190.—Traction dressing for fracture of the shaft of the humerus. A weight is suspended by adhesive straps reaching above the site of the fracture. Coaptation splints are next applied. A triangular pad is placed in the axilla, the thickness depending on the abduction desired. This pad may be easily made out of a newspaper and towel stuffed with cotton.

This method employs the principle of traction and avoids fixation of joints, features whose value the experience of the late war has conclusively demonstrated. Traction is obtained by hanging a weight of 1 or more pounds on the arm by means of adhesive straps, as illustrated in Fig. 190. The wrist (not forearm) is supported by a sling so that the forearm is carried at a right angle and the weight of the arm contributes to the traction.

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[1] Truesdell, E. D.: Birth Fractures and Epiphysela Dislocations, Paul B. Hoeber, New York, 1917, pp. 111–116.

If the fracture is not at one extremity or another of the bone coaptation splints are put on the arm. Finally an axillary pad is applied, its width depending on the amount of abduction required.

Probably the ideal method of treating fractures of the humeral shaft, particularly those with a tendency to displacement, is suspension and traction with the patient in bed. Patients with such fractures, however, ordinarily cannot or will not stay in bed for three or four weeks. The method described above is an ambulatory application of traction, its principal deficiency, as compared with combined suspension and traction, being in its lesser control of abduction and rotation of the lower fragment. It is fair to say, however, that the cases where conditions cannot be met satisfactorily with it are the exception and not the rule.

The advantages in brief are as follows: Traction obviates the necessity of a "reduction" in the majority of cases as the deformity is continued by spasm of muscles which is quickly overcome by the weight of the arm plus the weight applied. Furthermore, the muscles thus made tense act as an encircling splint to the broken bone. By increasing or decreasing the weight and the amount of abduction the position if not satisfactory at first try can be corrected with little disturbance to the patient.

The avoidance of fixation at the shoulder and elbow mean an earlier return to normal function. You will note that the patients I am about to show have obtained early motion.

The patients are, in my experience, very comfortable.

Finally, and this is an asset of any procedure in surgery, the method is simple. It is quickly and easily applied and with the exception of the weight or shot-bag only makes use of materials that are found in every office.

It is a principle in the treatment of fractures that the joints above and below the break should be immobilized. The suspension and traction treatment has demonstrated that this is not always necessary, but it remains true when rigid splints are used. And it is just here that it seems to me the commonly used molded splints are likely to make trouble. They do not immoblize the shoulder sufficiently while fixing the elbow, so that the broken ends instead of being immobilized are, on the contrary, moved on each other when the arm is moved. Another result is likely to be angulation. In one of these patients before us, A. B., such an angulation (Fig. 199) shown in lateral *x*-ray, when she was in anterior and posterior molded splints, was corrected by discarding the splints and applying traction. A plaster cast of trunk, arm, and forearm will, of course, give satisfactory immobilization, and if the position obtained is good the result should be good. Such a plaster is time consuming to put on, cumbersome for the patient, and if the position obtained is not satisfactory its correction requires reapplication.

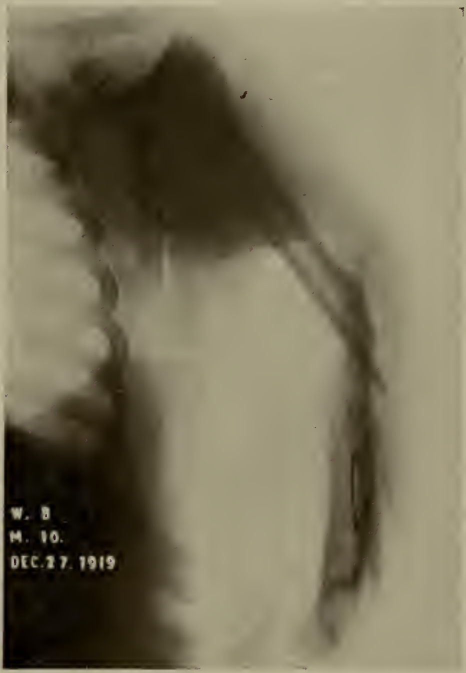

Fig. 191.—Fracture in midportion of humeral shaft before treatment.

As a disadvantage of the ambulatory traction method it may be urged that traction is not continuous, ceasing when the patient lies down. This is true, and yet practical experience has shown that it is not productive of harm. After the position has been corrected and the muscular spasm overcome, reduction is maintained for the period of rest. If there is any recurrence of deformity it is overcome again when the patient gets up. In one of the patients here (W. B.) radiographs were made in both erect and prone positions and the slipping in the latter was negligible.

Another theoretic disadvantage urged is danger of non-union because of lack of immobilization. As you know, the humerus is particularly liable to this unfortunate complication. The same argument was used against suspension and traction treatment of war fractures, but experience did not bear it out. In my few cases union has been prompt.

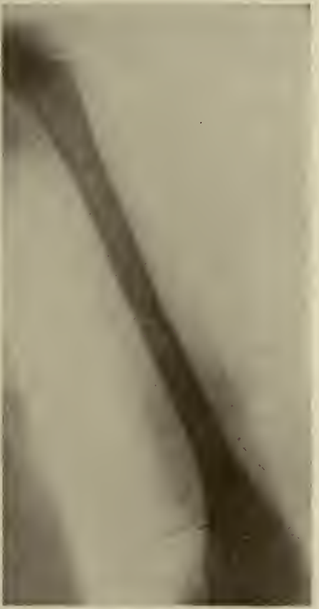

Fig. 192.—Same as Fig. 191 after being put up with traction weight.

The first patient of this series that I am going to show you, W. B., aged ten years, applied to the clinic the day after breaking his right humerus about the middle as the result of a fall. Figure 191 is a radiograph made at that time. Traction, coaptation splints, and an axillary pad were applied. Figures 192 and 193

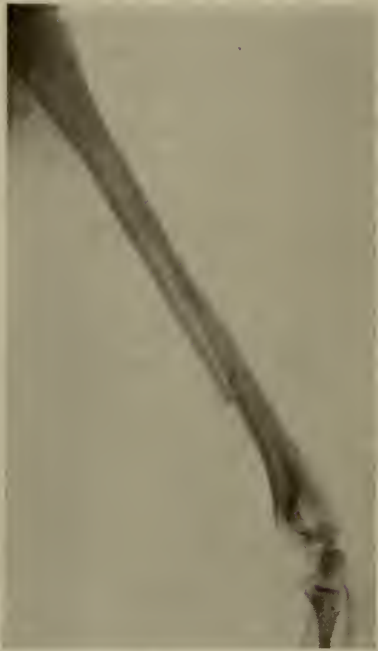

Fig. 193.—Same as Figs. 191, 192, and 194 after union.

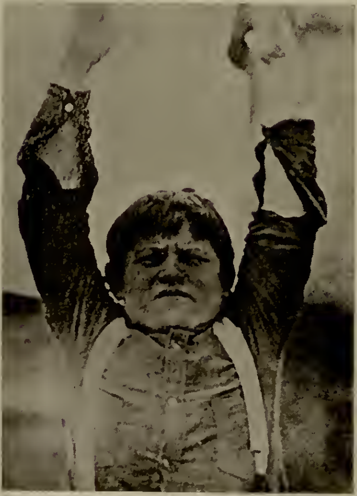

Fig. 194.—Photograph of same patient as Figs. 191–193 about one month after injury.

show the result. The weight was carried for two weeks. Figure 194 is a photograph made about one month after injury. At this time motion in the elbow and shoulder was about normal. It must be admitted, of course, that children regain function more rapidly than adults, yet this is a prompt return of function.

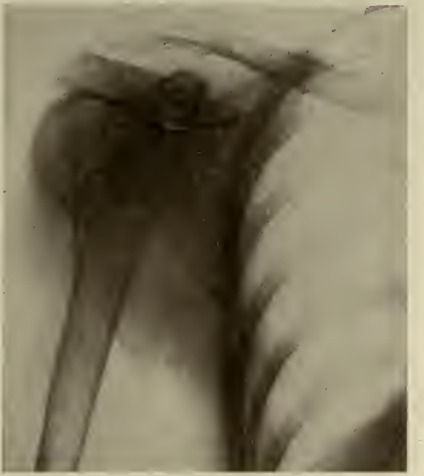

Fig. 195.—Fracture at surgical neck before treatment.

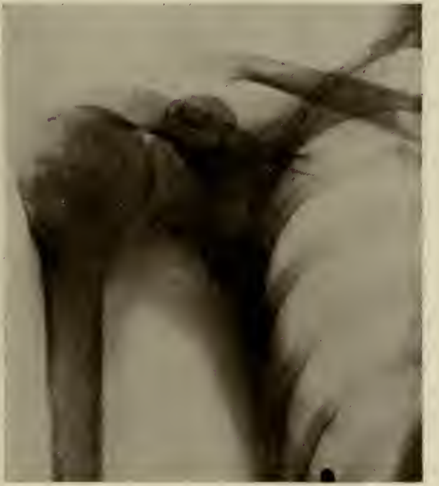

Fig. 196.—Same as Fig. 195 after union had taken place.

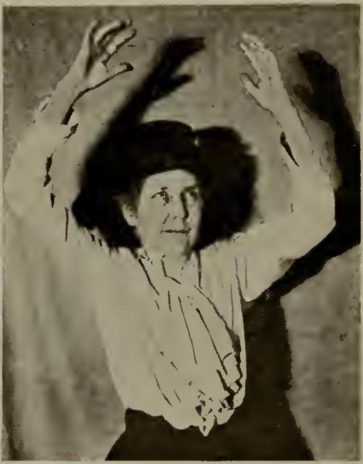

Fig 197.—Same as Figs. 195 and 196. Photograph made about six weeks after injury.

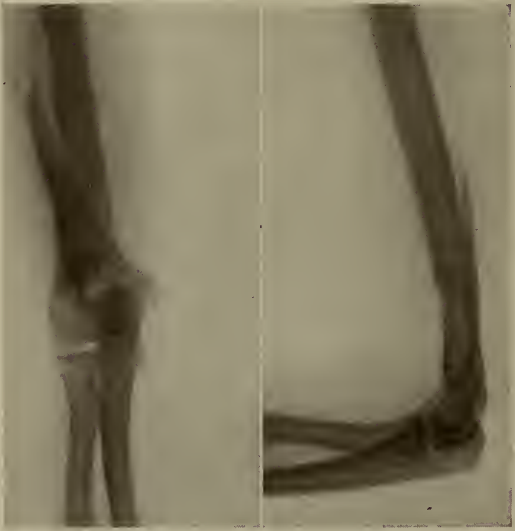

Fig. 198.—Mrs. A. B., thirty years old. Fracture of lower third of left humerus.

E. N., aged fifty-five, applied for treatment the day after falling and striking her left shoulder. There was a fracture at the surgical neck with some displacement as shown in the radiograph (Fig. 195). On examination the head moved with the shaft, indicating an impacted fracture. Traction was applied. As her muscles were feeble the weight was discontinued at the end of five days, the extremity alone serving as sufficient traction. Figure 196 shows the result at the end of treatment. Figure 197 is a photograph made about six weeks after the injury. At this time it was noted that she could do ordinary things, but that there was still some limitation of complete abduction at the shoulder.

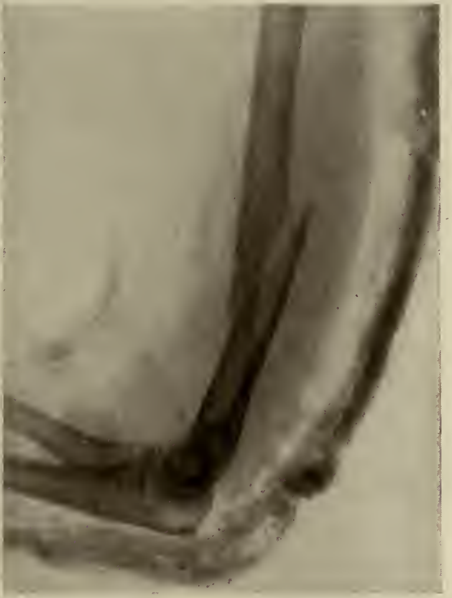

Fig. 199.—Same as Fig. 198, showing that anterior and posterior molded splints angulated the arm more than before.

A. B., aged thirty, fell down stairs, breaking her left arm. Figure 198 shows the fracture. The displacement was not great. She was tried with molded plaster splints and with Jones' traction arm splint, but neither were satisfactory, the former especially causing angulation in lateral view (Fig. 199). At the end of a week a weight was hung on with coaptation splints and a small

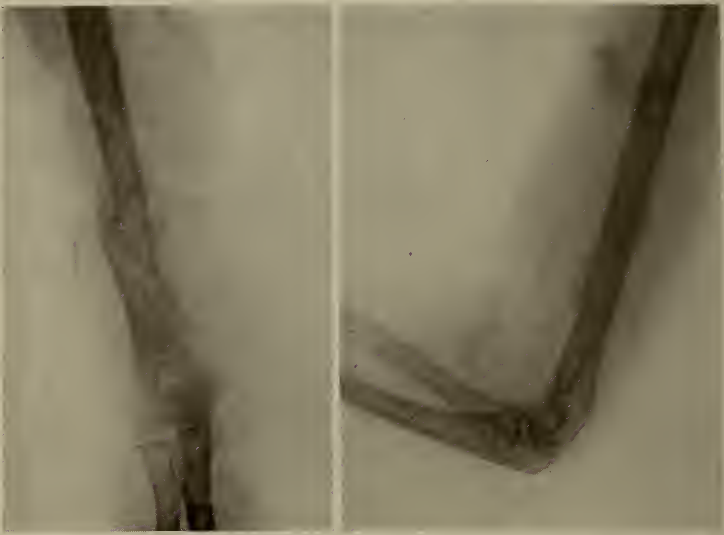

Fig. 200.—Same as Figs. 198 and 199. End-result of treatment after weight traction.

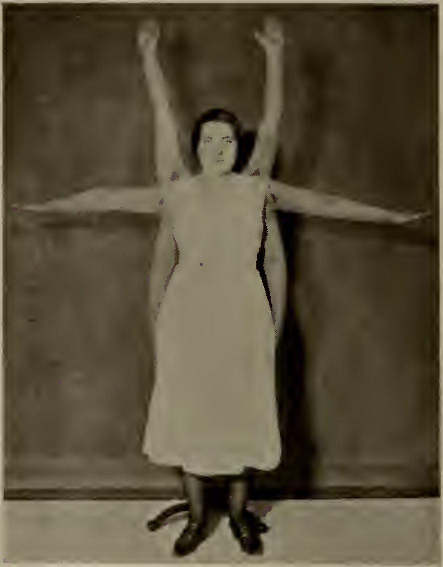

Fig. 201.—Same as Figs. 198–200. Superimposed photograph made at end of two months.

axillary pad. The weight was maintained for ten days. About five weeks after the injury it was noted that flexion of the elbow was nearly normal, extension three-fourths normal. Figure 200 shows the end-results radiographically. Figure 201 is a superimposed photograph made to show shoulder function eight weeks after injury. Shortly after this she was discharged from the massage clinic as cured.

It must be stated that, as in other methods, not all humeri treated by traction show ideal reductions radiographically. Clinically, however, the results have been good. And where the broken ends of the bone have not fitted in together perfectly, as shown by *x*-ray, the general alinement of the arm has been straight, thanks to the traction. Figure 202, the radiograph of a patient during treatment, illustrates the point. Clinically his result was perfectly satisfactory. You note that the bone is straight and without shortening, although the broken ends do not mortise.

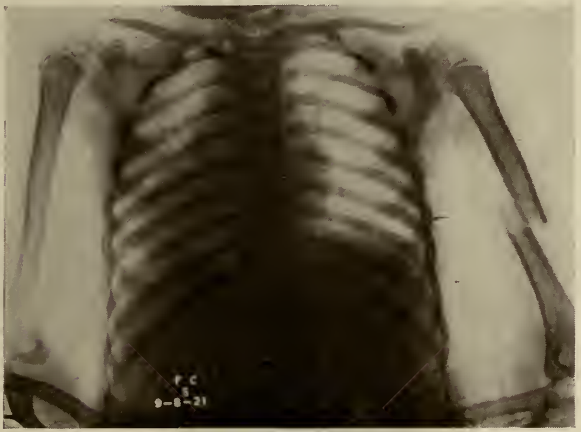

Fig. 202.—Fracture of middle of shaft of humerus. Although the broken ends do not mortise, the general alinement is good, and there is no shortening.

To sum up briefly, traction by the weight of the extremity plus one or more pounds hung on the arm, coaptation splints, and an axillary pad are a method of treatment for fractures of the humeral neck and shaft which is applicable in the majority of cases, is simple, provides a reduction without an operative procedure, and maintains it, and allows early return of joint function.

SKELETAL TRACTION IN FRACTURE OF FEMUR

The last patient I propose to show you, B. E., aged eleven, was admitted on July 18, 1921 to St. Luke's Hospital. Two days previously he had fallen out of a tree and sustained a fracture of the left thigh at the juncture of the upper and middle third. You see from the *x*-ray (Fig. 203) that there was marked overriding. As the shortening and deformity was pronounced it seemed to me unlikely that skin traction would be satisfactory and that the choice of treatment lay between open reduction and skeletal traction. The latter was chosen because it is efficient and simple and because the risks of an open operation seemed, therefore, unjustifiable.

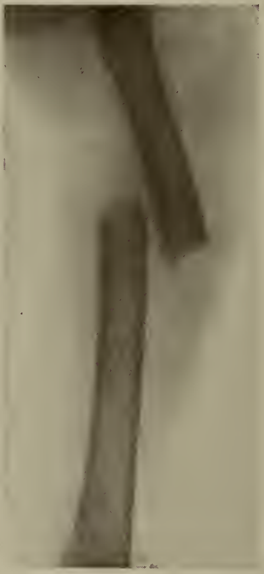

Fig. 203.—B. E., aged eleven. Fracture of upper half of left thigh with marked overriding.

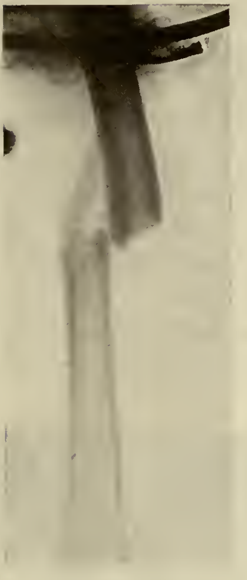

Fig. 204.—The same as Fig. 205. Anteroposterior view after a month's treatment.

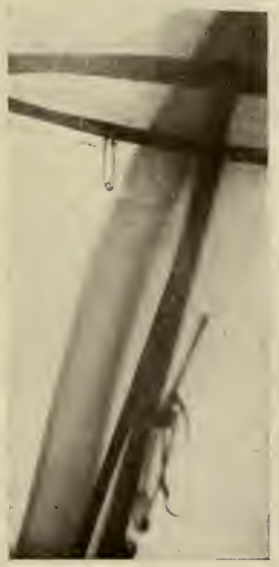

Fig. 205.—The same as Fig. 204, lateral view.

Figures 204 and 205 show the result after a month of tong traction with suspension. Anteroposteriorly you note that the general line of the thigh is straight, there is no shortening, and callus is already visible, although the fragments are not on end. Laterally the alinement is good. The tongs were removed after fifty-three days, at which time union seemed firm. One week later the patient was up on crutches. When he was discharged from the hospital both legs measured the same.

Today, over a year since injury, he states that he can use his leg just as well as ever. You note that on inspection one could not tell which is the fractured thigh. Measurement reveals, however, that the injured extremity is ½ inch longer than its fellow. This stimulation to growth after fractured femur has been called attention to recently by Truesdell.[1] The boy does not know of this disparity in length and it causes him no inconvenience. Figure 206 shows the present appearance of the femur.

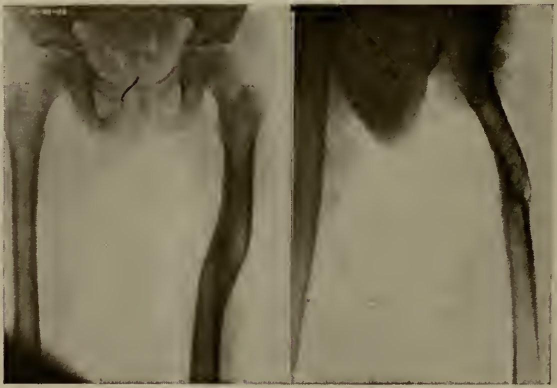

Fig. 206.—Final result one year later of Figs. 203 and 205.

I have shown you this case because it illustrates the value of skeletal traction in fractures of the femur and shows that childhood is not necessarily a contraindication to its employment, as some have feared, on account of danger to the epiphyseal line.

[1] Truesdell, E. D.: Annals of Surgery, 74, 498, 1921.

Of course, care should be exercised in applying tongs in children to insert well above the line. In general, while the use of skeletal traction is well known and widely employed, it seems to me that its applicability, efficiency, and simplicity are not wholly realized.

CLINIC OF DR. BYRON STOOKEY

New York Neurological Institute and New York Post-Graduate Medical School and Hospital

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INSIDIOUS PARALYSIS OF THE INTRINSIC MUSCLES OF THE HAND AND ITS OPERATIVE RELIEF

Insidious paralysis of the intrinsic muscles of the hand may be the presenting symptom in a variety of lesions, often obscure, which differ in their pathology, their anatomic level, and in their mode of treatment. A certain number of these may be relieved by properly directed surgical measures. Atrophy and paralysis of the small muscles of the hand should direct attention to the last cervical and first thoracic segments of the spinal cord and the entire nerve path from these segments to their final peripheral distribution (Fig. 207). To determine the level of the lesion a thorough motor examination must be made of the individual action of each muscle of the arm, forearm, and hand, and also a careful sensory study, testing not only tactile, pain, and temperature but also vibratory and muscle-joint sense. As a differential factor the sensory examination is, perhaps, most helpful, distinguishing at once certain pathologic conditions which may be eliminated, thus narrowing the field from which the differential diagnosis should be made. We shall thus divide insidious paralysis of the hand into two groups dependent upon the presence or absence of sensory changes.

A. *Insidious paralysis of the hand with no sensory changes—the efferent pathway alone involved:*

1. Chronic poliomyelitis.
2. Amyotrophic lateral sclerosis.
3. Progressive muscular atrophy.
4. Intradural spinal cord tumor involving the ventral root of eighth cervical and first thoracic segments.

B. *Insidious paralysis of the hand in which sensory changes are found—both efferent and afferent pathways involved:*

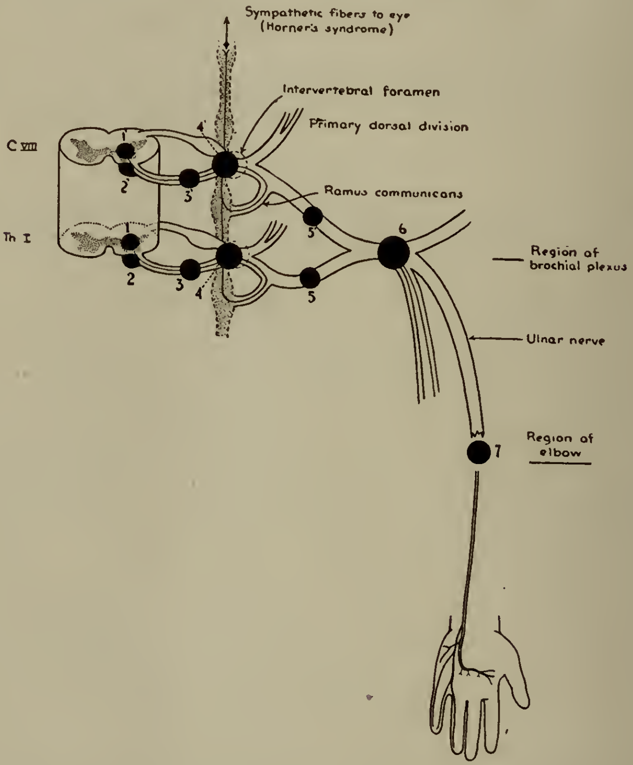

Fig. 207.—Schematic drawing of C. VIII and Th. I segments and peripheral nerve path to show location of various lesions which may cause insidious paralysis of the intrinsic muscles of the hand: 1 and 1′, Lesion within the ventral gray horn—intramedullary; 2 and 2′, lesion compressing the ventral gray from without, may be extramedullary and intradural, or extradural; 3 and 3′, tumor of the ventral root; 4 and 4′, tumor of combined dorsal and ventral roots before sympathetic fibers to the eye are given off; 5 and 5′, of combined roots after sympathetic fibers to the eye have been given off; 6, lesion in region of brachial plexus; 7, lesion of ulnar nerve which may be anywhere in its course.

1. Syringomyelia.
2. Intramedullary spinal cord tumor at eighth cervical and first thoracic segments.

3. Intradural spinal cord tumor involving both ventral and dorsal roots of eighth cervical and first thoracic segments.

4. Extradural and paravertebral tumors involving the eighth cervical and first thoracic nerve roots.

5. Cervical ribs.

6. Lesions about the elbow-joint, giving rise to pressure signs of the ulnar nerve at this level.

7. Tumors of the ulnar nerve.

8. Leprosy.

Case I.—Patient 2292. August, 1922. G. P., aged forty-one; married, Italian; occupation, soda water bottler.

Complaint.—Weakness in left hand, shriveling up of left hand, dull ache of left hand.

Character of First Symptom.—Weakness of left hand.

Date of First Symptom.—October, 1920.

Progress.—Worse, no remissions.

History.—During the past eighteen months patient has gradually lost the power of his left hand. He first noticed this after working part of the day. When he went to work in the morning his hand did not feel noticeably weak, but did so after a few hours' work, when he would have to stop in order to rest his hand. Gradually his hand became so weak that he has been unable to follow his occupation. About ten months ago, that is, eight months after the onset, he noticed a dull pain in the region of his shoulder, which was constant and radiated somewhat to the front of his chest. This pain is not present at this time, but now the patient complains of pain on the inner surface of the arm and hand. His hand falls asleep very readily and there is a burning sensation in it which is intermittent in character.

Injuries and Diseases.—Patient has had no injuries and has never been ill. He admits syphilis twenty years ago and gonorrhea at the same time. He has had no clinical manifestations from his infection twenty years ago, nor has he had any treatments up to the present time.

Habits and General Physiologic Status.—Tea and coffee moderately, tobacco moderately, occasionally beer; sexual life is normal; sleeps well; his appetite is good; he has had no trouble with his urination.

Family History.—Four children and no miscarriages; wife is healthy and well.

Physical Examination.—*Voluntary Motor System.*—No abnormal attitudes and deformities except the atrophy of the left hand and along the inner surface of the left forearm.

Gait.—Normal in all its phases; walking on toes and heels and on a line is well performed.

Co-ordination.—Equilibratory: Standing with feet together, both with eyes open and closed, normal. Non-equilibratory: Finger-to-finger, toe-to-object above recumbent, heel-to-knee, along shin, are all normal.

There is no adiadokokinesis.

Skilled acts are normally performed in the right hand; the left hand cannot be tested because of weakness.

Abnormal Involuntary Movements.—A slight tremor, fine and irregular in both the right and left hands, is present. No fibrillary twitchings seen.

Reflexes.—Deep:

	Left.	Right.
Pectoral	0	+
Biceps	+	+
Triceps	0	+
Radial	+	+
Ulnar	0	0
Patellar	+	+
Hamstrings	+	+
Achilles'	+	+

No ankle-clonus.

Superficial:

Abdominals, barely present.

Cremasterics, present.

No Babinski, or any of its modifications.

Muscle Strength.—Normal throughout, with the exception of the left hand, which shows marked weakness in both flexion and extension, with marked atrophy of the intrinsic muscles.

Electric examination shows reaction of degeneration of the hypothenar group, interossei and deep muscles of the thenar eminence; marked wasting of the interosseous spaces, the first being particularly noticeable.

There are no abnormal associated movements.

Laboratory Examination.—Blood, spinal fluid, and urine were normal. Wassermann in both blood and spinal fluid negative.

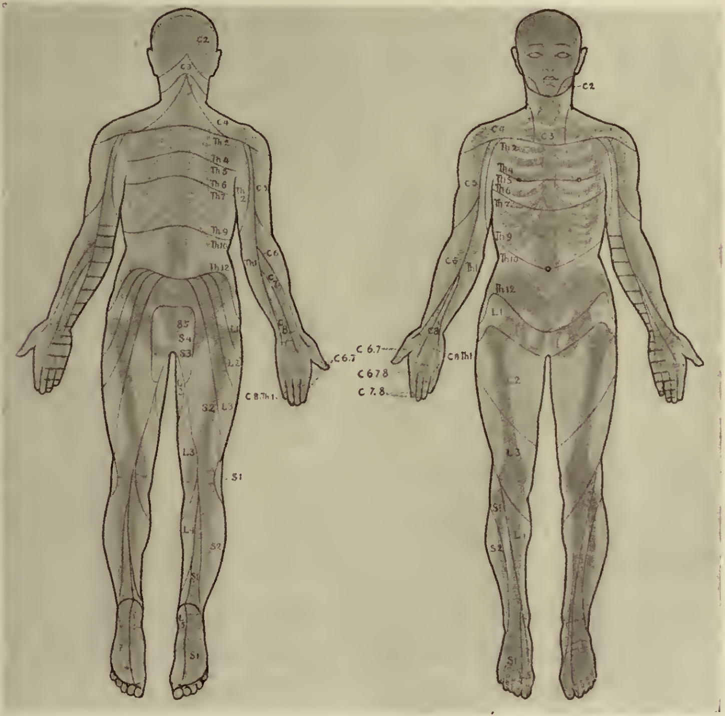

Fig. 208.—Chart in Case I, to show area of anesthesia. All forms of cutaneous sensibility involved in area showing cross marking.

General Sensory Examination.—Shows sensation to be normal throughout; normal to touch localization and discrimination, as well as to pain and temperature, with the exception of the left hand and inner surface of the left forearm (Fig. 208).

Vibratory is not disturbed except in the distal two phalanges of the fifth finger.

Muscle-joint sense is unimpaired.

Nerves.—Olfactory nerve is normal. Vision and fundi show no changes. The pupils: The right is greater than the left. The position is central and their shape irregular. Hippus is absent. Reaction to light and convergence is normal. No Argyll-Robertson pupil. The palpebral fissures are unequal, the right being greater than the left. Hornor's syndrome present on the left. The left side of the face does not sweat.

The remaining cranial nerves show no abnormality.

General Systemic Examination.—No pathologic conditions noted. Heart, lungs, and abdomen show no abnormality.

The presenting symptom in this man is an insidious paralysis of the intrinsic muscles of the left hand. The motor examination shows a paralysis of the intrinsic muscles of the hand with reaction of degeneration and also a weakness of the flexors along the inner border of the forearm. No other motor weakness is made out. However, the routine sensory examination revealed sensory changes extending up the forearm and on to the inner surface of the arm as far as the base of the axilla.

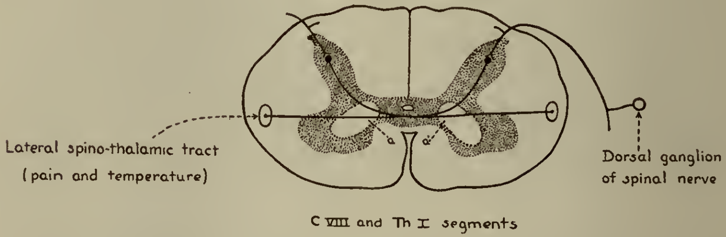

Fig. 209.—Schematic drawing of cross-section of spinal cord to show decussation of pain and temperature fibers in the central gray. A lesion at *a* or *a'* would give rise to atrophy of intrinsic muscles of the hand on the same side as the lesion and loss of pain and temperature in both hands.

The cutaneous areas thus involved point to the dermatomes of the eighth cervical and first thoracic nerves. As will be seen from the chart, all modalities of superficial sensation are equally implicated, including tactile, pain, and temperature. No other areas of changed cutaneous sensibility are to be found.

If this were a lesion due to syringomyelia we would expect to find a dissociation of sensation in which pain and temperature would be lost with tactile acuity retained due to the fact that the pathologic changes in syringomyelia are in the central gray of the spinal cord where pain and temperature fibers cross (Fig. 209). Thus, in syringomyelia, the fibers carrying these types of sensation are involved, while tactile and the other forms of sensibility usually escape or are but slightly involved. Furthermore, if this were syringomyelia one would expect to find loss of pain and temperature in both hands, since the fibers from both sides would be involved as they decussate in the central gray. While this may not be the only differential point, it is perhaps the most important, and will suffice to enable us to rule out syringomyelia in this patient. The same reasoning may also be applied to rule out an intramedullary spinal-cord tumor involving these spinal segments, since in an intramedullary spinal-cord tumor one would expect also to find a dissociation of sensation in which pain and temperature would be more involved than tactile. In intramedullary disease the greatest sensory disturbances are at and immediately below the level of the lesion, while the more distal cutaneous areas are less involved.

Sensory changes such as we find here cannot be due to a lesion of the ulnar nerve alone, since areas of anesthesia are found which are not under the domain of this nerve. Neither do the areas involved correspond to any single cutaneous nerve, but rather they are segmental, that is, corresponding to root and not peripheral nerve distribution. Consequently, we must look for the lesion in this patient in some part of the nerve path where the eighth cervical and first thoracic roots may be involved. This may be anywhere from the origin of the ventral and dorsal roots within the dura to their formation and differentiation into the secondary cords of the brachial plexus, or the nerves which arise from them, namely, the inner head of the median, the ulnar, and the lesser internal cutaneous.

If the lesion were a tumor involving the eighth cervical and first thoracic nerve roots within the dura we could account for the sensory and motor changes found. Such a lesion would, in fact, explain everything present in this patient. But a tumor sufficiently large to involve both of these roots would certainly cause some pressure on the spinal cord, and we would have, in addition to the motor and sensory changes here presented, signs referable to the conduction paths of the spinal cord, especially those of the pyramidal system giving rise to altered pathologic reflexes, such as ankle-clonus, Babinski, or its modifications. Sensory changes also would probably be found in the lower extremities and the trunk, since in extramedullary intradural tumors sensory changes are usually greatest in the more peripheral segments. None of these signs are present in the patient, and in the absence of such signs intradural spinal cord tumor must be considered as most improbable if not excluded altogether.

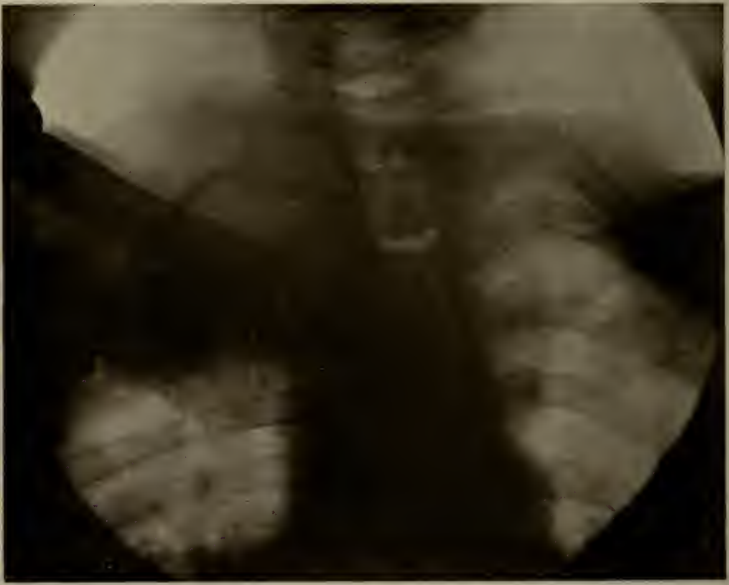

Fig. 210.—x-Ray of first patient to show paravertebral tumor in region of C. VIII and Th. I. vertebræ. (Position reversed in printing due to fact that *x*-ray was made on a plate which does not permit of reversal.)

We have thus narrowed the location of the lesion so that it must lie somewhere between the dura and the formation of the inner secondary cord of the brachial plexus. There are no somatic motor nerves arising from the eighth cervical and first thoracic nerve roots in this region, which by paralysis might serve to localize the exact level of this lesion with greater precision. However, a very important group of symptoms may be found in lesions of the eighth cervical and first thoracic roots. If the symptoms are present, the lesion is very close to the intervertebral foramina of exit of these nerves, and certainly central to the point at which the sympathetic rami communicans arise (Fig. 207). If the eighth cervical and first thoracic roots are involved before the origin of sympathetic rami communicans is given off, the pupillary sympathetic fibers which pass out in these nerve roots to join the inferior cervical sympathetic ganglion would be implicated and give rise to a classical syndrome, the syndrome of Hornor, which is characterized by inequality of the pupils, that of the affected side being the smaller, that is, anisocoria and myosis; by narrowing of the palpebral fissure; sinking in of the eyeball, that is, enophthalmos, and

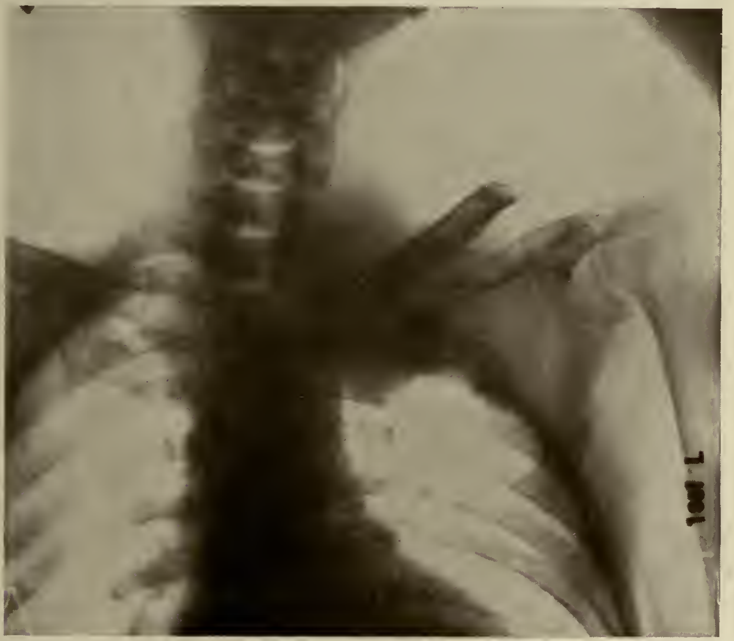

Fig. 211.—x-Ray of same patient taken six months later.

a unilateral flushing of the face, with loss of sweating on that side.

In this patient anisocoria, myosis, narrowing of the palpebral fissure, enophthalmos, with loss of sweating on that side of the face, are all present; thus, since the cervical sympathetic fibers are involved, we are enabled to locate the lesion as close to the intervertebral foramina of exit through which the eighth cervical and first thoracic roots pass. The most probable nature of a lesion in this region giving rise to slowly progressive paralysis

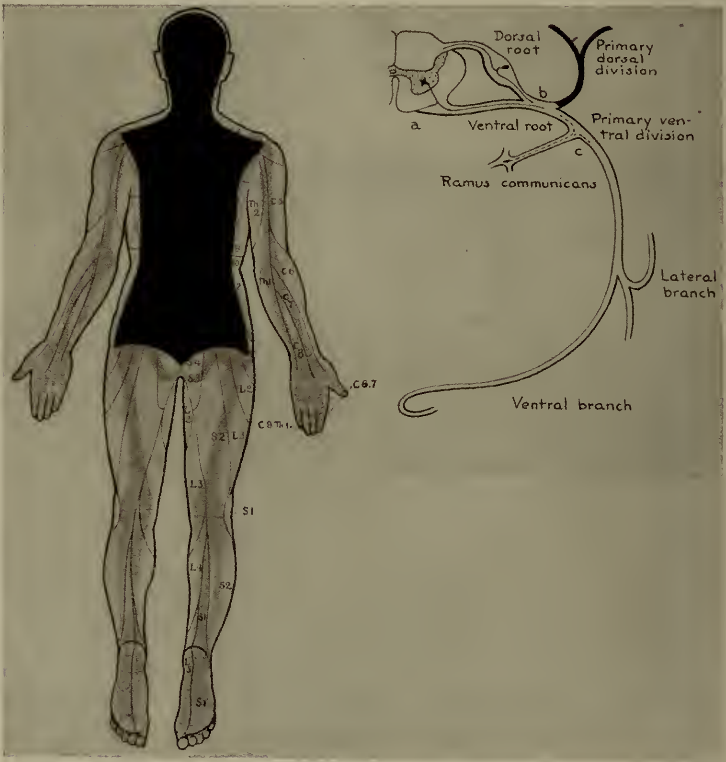

Fig. 212.—Figure to show area of skin supplied by the primary dorsal divisions—shaded area included between parieto-acromio-trochanteric-ischial lines. The remainder of the trunk and both the upper and lower extremities are innervated by the primary ventral divisions. Insert shows typical spinal nerve with primary dorsal division in black to correspond with area on trunk which they supply—primary ventral division unshaded.

is a paravertebral tumor. This is the only conclusion which can be reached from the anatomic findings. Palpation in the cervical region suggests confirmation of the diagnosis, but palpation of this region is most unsatisfactory, and palpation alone is not sufficiently reliable.

x-Ray examination has been made, and shows a mass on the left side of the vertebral column which undoubtedly involves the eighth cervical and first thoracic nerve roots, thus giving rise to the slowly progressive paralysis with atrophy of the intrinsic muscles of the hand (Figs. 210 and 211). This patient was first seen very early in his illness, at which time no tumor was found, and it was thought that he had signs possibly referable to a cervical rib. The *x*-ray revealed a small cervical rib which in itself was not enough to account for his signs. However, it must be borne in mind that an *x*-ray showing only a short cervical rib does not necessarily rule out the presence of a cervical rib which might give rise to signs, since the rib may be continued forward as a dense fibrous band. Of course, such a band does not show in the *x*-ray, and, consequently, the *x*-ray alone cannot rule out the presence of cervical rib pathology. I have never seen Hornor's syndrome due to a cervical rib.

Exploratory operation was advised, but refused. The patient then left the Neurological Institute, where he was under observation, and appeared at the Post-Graduate Hospital. At this time the diagnosis of paravertebral tumor was definitely made. Operation was again advised, and again the patient refused. The patient has returned again to the Neurological Institute to have anything done for him, saying that he had refused operations before because an outside physician, a compatriot, who attended him during visiting hours, unbeknown to the house staff, advised him against any operative procedure. Unfortunately at the present time operation would be inadvisable, and *x*-ray therapy or radium will be recommended.

Case II.—Date, March 1921. Occupation, broker. Nationality, American. Single. Age thirty-eight.

Complaint.—Weakness of left hand.

Character of First Symptom.—Weakness of left hand.

Date of First Symptom.—Not definitely known, thought to be about 1918–1919.

Onset.—Gradual and progressive. No remissions.

While overseas serving as an officer in the American Army, during which time his duties were very much more active than thay had ever been before, he noticed that weakness of his left hand gradually came on, and that at night while asleep there would be a numbness and tingling sensation in the left hand. This tingling sensation also came on during the daytime on resting his arm on the table and in numerous other positions. Except for the weakness and numbness the patient has felt perfectly well, has lost no weight, has had no nocturnal headaches and no disability in his gait; there have been no other paresthesias.

Past History.—Entirely negative. He has never been sick, never unconscious, nor has he had any injuries except, when six years old, he broke his left arm.

Habits and General Physiologic Status.—Entirely negative. His family history is unimportant.

Physical Examination.—*Voluntary Motor System.*—No abnormalities except the weakness of the left hand.

Gait.—On toes, heels, and on a line, all normally performed. Fournier's tests are negative.

Co-ordination.—Equilibratory: Standing with feet together, eyes open and closed, and on either foot, normally performed.

Non-equilibratory: Finger-to-nose, finger-to-finger, toe-to-object above recumbent, heel-to-knee, along shin, are all normal.

No adiadokokinesis; no dysmetria.

Skilled acts are normally performed.

There are no abnormal involuntary movements, and no tremors are noted.

Deep Reflexes.—Upper and lower extremities show no alterations from normal.

Superficial Reflexes.—All normal. There is no Babinski or any of its modifications.

Muscle Strength.—No motor weakness made out except in the left hand.

Examination of individual muscular action shows that the muscles paralyzed are the interossei; the flexor pollicis brevis (interosseus primus volaris); and the abductor pollicis, transversus and obliquus, and those of the hypothenar group.

In the forearm the flexor carpi ulnaris shows only slight weakness, but no apparent weakness could be made out in any of the remaining muscles of the forearm. The musculature of the shoulder-girdle is normal and no focal weakness or changes in electric reactions could be made out except that the electric examination of the intrinsic muscles of the left hand shows polar equality, that is, ACC = CCC. Reaction of degeneration is not present.

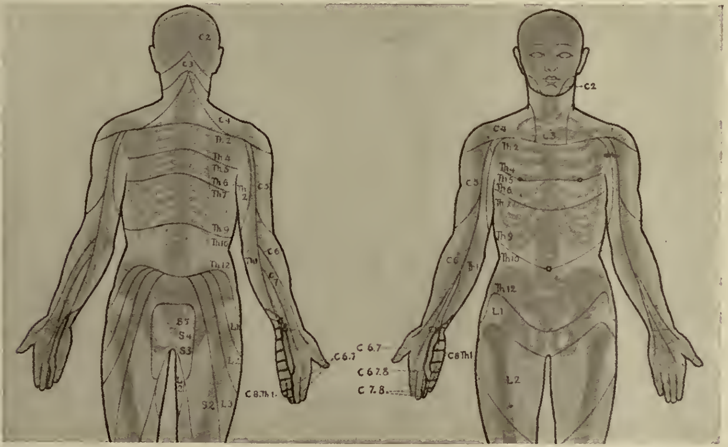

Fig. 213.—Chart in Case II to show area of anesthesia in distribution of the ulnar nerve. All other cutaneous areas normal.

There are no abnormal associated movements.

General sensory examination is negative throughout with the exception of the left hand (Fig. 213).

Cranial nerves are all normal.

General systemic examination normal.

Laboratory Examination.—Blood examination, including Wassermann, negative; urine negative.

The presenting symptom in this patient, as in the first, is an insidious paralysis with atrophy in the intrinsic muscles of the hand.

Let us now interpret the results of the motor examination. First, the lesion must be somewhere in the lower motor neuron either in the ventral horn cells or along some part of the peripheral path of their axones, since atrophy and changes in the electric reactions are present.

If the injury were supranuclear, that is, above the ventral motor cells, atrophy and electric changes would not be found. If the pyramidal tracts were involved, paralysis would be present without atrophy and without changes in the electric reactions. Paralysis of this type is called "upper motor neuron paralysis," and is characterized by normal electric reactions and spasticity with increase of the reflexes, while, when the lower motor neuron is involved, electric reactions are altered showing either polar equality, or if the stage is further advanced, reaction of degeneration; atrophy is present and in place of spasticity with increased reflexes atony is found with diminished or abolished reflexes. If a chronic process in the ventral horn cells were responsible for the paralysis and atrophy we would expect to find fibrillary twitchings in the muscles, but these are not present. However, fibrillary twitchings are not always indicative of chronic intramedullary disease of the ventral horn cells. They may be found in the tongue musculature after section of the hypoglossal nerve, in paramyoclonus multiplex, and in extramedullary spinal-cord tumors which lie ventral to the spinal cord. In experimental work fibrillary twitchings are seen in any muscle which is cut off from its nerve supply.

The spinal segments responsible for the involved muscles in this patient are the eighth cervical and first thoracic, but all muscles supplied by these two segments are not implicated. Nor can we attribute the paralysis to either the eighth cervical alone or first thoracic alone, since the paralysis is greater than the distribution of either of these segments. In short, the muscular involvement is not purely segmental. It does not correspond in its distribution to either one of these segments or to both of them combined.

If the lesion is not segmental, neither can it be considered radicular, that is, involving the nerve-roots prior to their formation of the peripheral nerves which arise from the plexus, since the muscular distribution of the nerve root is also segmental. Hornor's syndrome is not present, consequently the lesion must be distal to the intervertebral foramen. Thus, from the motor examination, the lesion must be at or distal to the formation of the peripheral nerve-trunks arising from the inner cord of the brachial plexus.

We shall now turn to the sensory examination. We find that the sensation is normal along the inner border of the arm and in the axilla—areas supplied by the eighth cervical and first thoracic segments and also by the internal and lesser internal cutaneous nerves. We may thus safely rule out from the sensory examination that the lesion is segmental, thus confirming the conclusion reached as a result of the motor examination. However, there is still another test which may be done before such a conclusion is wholly justified. It will be recalled that immediately after the formation of a mixed spinal nerve each divides into two primary divisions—a ventral primary division and a dorsal primary division. The ventral primary division enters into the formation of the limb plexus in the lower cervical and lumbosacral regions, while in the upper cervical and thoracic regions these divisions supply the lateral and ventral trunkal musculature and the overlying skin. The primary dorsal divisions *never* enter into the formation of the limb bud and *never* supply lateral or ventral musculature, but supply the dorsal axial musculature and the overlying skin. The area of cutaneous sensation supplied by the dorsal primary divisions is, therefore, restricted to the head and trunk, and is limited laterally by two curved lines drawn from the following points: beginning at the midparietal region of the cranial vault they extend laterally on either side to the mastoid, acromion, trochanter, and ischium, and are commonly called the parieto-mastoid-acromion-trochanteric-ischial lines (Fig. 212). This area of skin innervation is of great value as a means of more precise localization. If sensory changes are included within this area the

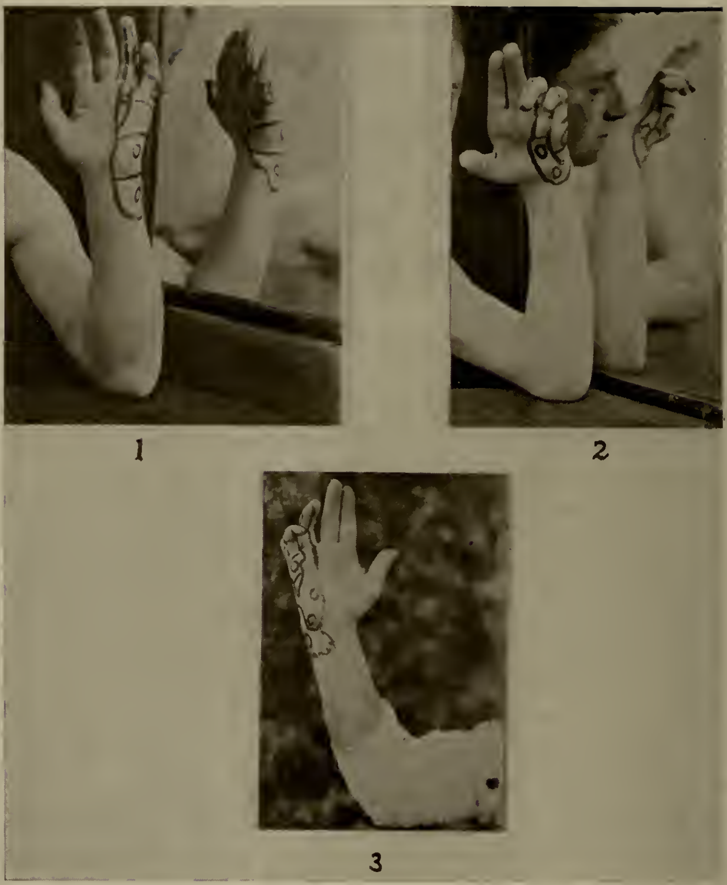

Fig. 214.—Photographs to illustrate the various types of anesthesia seen in ulnar nerve paralyses. The outer line shows loss to cotton wool; the inner area, loss to pin point, and the large circles indicate loss to extreme degrees of temperature. No. 1, Note the wide area involved on the dorsum of the hand and also the extension of the anesthesia on the postaxial border of the forearm. No. 2 shows a more typical distribution of ulnar anesthesia extending on the dorsum of the hand on to the lateral side of the fourth metacarpal bone. The anesthetic area terminates at the inferior fold of the wrist. No. 3, A zone of altered sensation-parasthesia is shown at the wrist included within the wavy line.

lesion must be at or central to the point at which the spinal nerves divide into dorsal primary divisions and ventral primary divisions.

There are certain variations in the distribution of some of the spinal nerves which are worthy of note; the first cervical nerve has no cutaneous representation; the seventh and eight cervical and the fourth and fifth lumbar also have no cutaneous representation on the dorsal surface of the trunk, due probably to the fact that these dermatomes are to a great extent absorbed in the formation of the limb plexuses. Thus, in this patient, examination of the skin on the dorsal surface of the trunk could reveal at the most a loss in the area in that region on the dorsum supplied by the dorsal primary division of the first thoracic. However, practically, it is almost impossible to detect a cutaneous sensory loss when only one segment is involved. In this patient we have examined the area supplied by the dorsal primary division of the first thoracic segment, and are not surprised or influenced by the fact that no sensory changes have been detected.

The sensory examination, however, shows a typical loss of sensation of pain, temperature, and tactile, corresponding to the area supplied by the ulnar nerve (see Fig. 213). The motor examination also shows paralysis corresponding to the muscular distribution of the ulnar nerve except that while complete paralysis and atrophy of the intrinsic muscles of the hand are present, only weakness of the flexor carpi ulnaris is found, with no appreciable change in the flexor profundus digitorum.

It may seem unnecessary to examine as extensively as we have done, but unless a complete examination is made, errors in diagnosis are inevitable.

Since the examination shows a lesion of the ulnar nerve to be present, it remains for us to determine at what particular point in its course the nerve is implicated, and what is the nature of the process. There is no trauma of which the patient is aware except, as you will recall, that when six years of age he broke his arm, but he has not complained of his fracture since. The arm does not bother him at this time, nor has he ever noticed any disability other than a slight limitation in flexion and extension. However, examination of the elbow shows a marked angulation and prominence of the medial epicondyle behind which the ulnar nerve passes (Fig. 215). Palpation of the nerve throughout its course shows no nodular enlargement and no thickening except possibly at the ulnar groove behind the medial epicondyle. By careful palpation a tumor of the ulnar nerve, which runs a rather superficial course, can be detected, but not always. We can only say that no tumor in the course of the ulnar nerve is palpable.

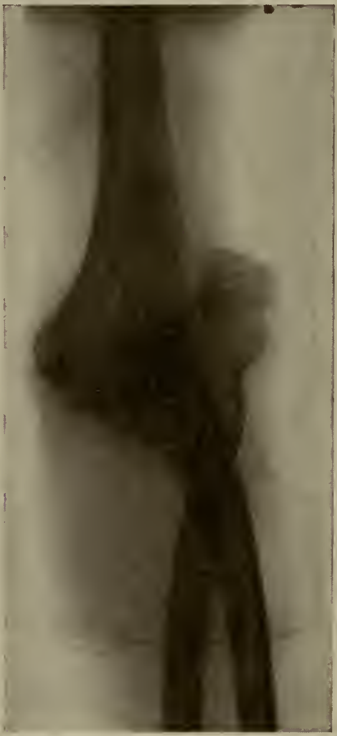

Fig. 215.—*x*-Ray of second patient to show angulation of left elbow due to old fracture.

Leprosy, though extremely rare in this country, may also cause thickening and tumor-like enlargement of a peripheral nerve. Of the peripheral nerves involved in leprosy, the ulnar is the most frequent. Leprosy of the ulnar nerve may give rise to slow progressive paralysis, with sensory changes. The sensory changes, however, make possible the diagnosis, for the skin is usually thickened and rough, appearing quite different from skin changes seen in any other nerve condition. If the history is gone into it is usually found that the patient has been in areas in which leprosy is endemic.

Cervical rib may also be considered, but pain is usually the more predominant symptom, and with a lesion at this level, with such advanced paralysis of the intrinsic musculature of the hand, paralysis and atrophy of the flexor carpi ulnaris and flexor profundus digitorum would be expected. As we have already indicated above, the absence of the cervical rib by *x*-ray unfortunately does not preclude the presence of a fibrous band, which may continue forward from even a very rudimentary cervical rib process around to the first rib or to the manubrium, and cause nerve pressure as effectively as a true bony cervical rib.

We know that an old fracture of the elbow with angulation may cause ulnar nerve signs many years after the injury—in another patient I have seen the first symptoms come on thirty-one years after the fracture. Apparently a fracture of the elbow may cause a low-grade trauma to the ulnar nerve in this region which may require many years to make itself felt. Frequently the onset of symptoms may be traced to new activities on the part of the patient in which the movements of the arm are greatly increased. Tingling is a frequent sign, though not always present. But angulation and fractures are not the only causes about the elbow which may give rise to ulnar symptoms. In some individuals the ulnar groove is poorly defined and shallow, so that subluxation of the ulnar nerve takes place in movements of the arm. Haim, Cohen, and others have found that subluxation of the nerve is not uncommon in an apparently normal elbow-joint.

A bursa is found beneath the ulnar nerve in the ulnar groove, and in one patient with ulnar nerve signs, a telephone operator, a chronic inflamed bursa was found at operation lying beneath the ulnar nerve within the ulnar groove. The diagnosis of bursa was not made until operation, the preoperative diagnosis being a tumor of the ulnar nerve. In several patients I have seen insidious paralysis of the hand due to a continued habit of sleeping with the arm acutely flexed with the hand beneath the pillow, producing paralysis in the ulnar musculature much the same as paralysis of the extensors of the wrist may be caused by sleeping with the arm in abduction—Saturday night paralysis.

Anatomy of the Ulnar Nerve at the Elbow.—Above the medial epicondyle the dorsal surface of the humerus shows a slightly channeled groove, the medial ridge of which leads into the ulnar groove. The ulnar nerve passes through this groove to reach the volar part of the forearm. Occasionally the medial ridge of this groove is increased in size as if to transform the groove through which the nerve passes into a bony canal. Such a bony canal for the ulnar nerve is found in some of the lower mammals. The periosteum of the ulnar groove is thickened and glistening and is overlaid by fibers of the internal lateral ligament of the elbow-joint. By the attachment of the brachial aponeurosis to the medial epicondyle and olecranon the ulnar groove is transformed into an osteofibrous canal. This aponeurosis is enforced by transverse fibers, frequently quite dense, extending from the region of the epicondyle on to the olecranon, and representing a remnant of the old epitrochleo-anconeus muscle of some of the lower mammals and occasionally present in man. The nerve is surrounded by loose connective tissue and separated from the floor of the groove by a bursa. Running with the nerve will be found the dorsal ulnar collateral artery, which may cause very troublesome bleeding.

Surgical Treatment.—Various methods of treatment have been advocated for the relief of pressure of the ulnar nerve due to increased angulation of the medial epicondyle.

1. Simple liberation of the ulnar nerve in the groove without transplantation.
2. Deepening of the ulnar groove.
3. Supracondylar osteotomy of the humerus.
4. Transposition of the ulnar nerve to the volar surface.

Any procedure which does not transpose the nerve is inefficient. Transposition is the operation of choice. It places the nerve in a position in which it is not exposed to trauma and gives to it a soft bed instead of a bony one. The dorsal part of the elbow is peculiarly exposed to trauma, and a nerve lying in a bony bed does not have the buffer protection which soft tissues afford. Furthermore, the constant movement of flexion and extension places the nerve under a certain degree of tension particularly during flexion.

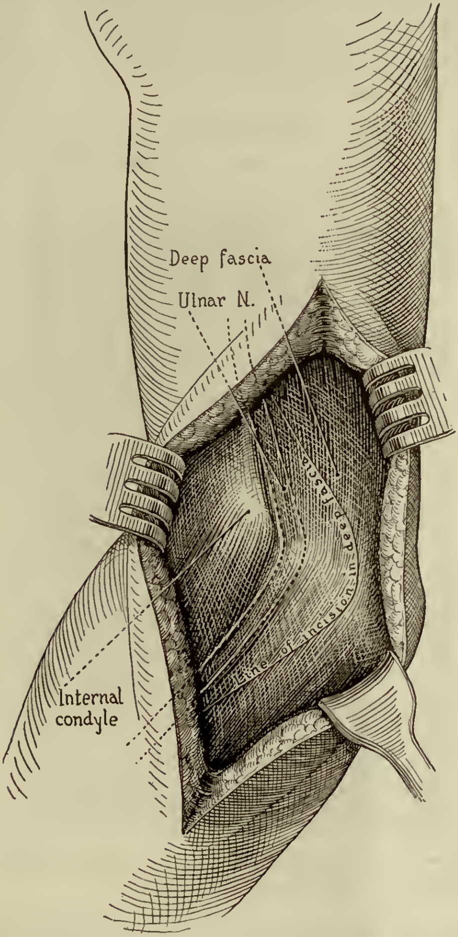

Fig. 216.—The deep fascia is cut in line of nerve so as to turn it over after transposition. (From Stookey, "Surgical and Mechanical Treatment of Peripheral Nerves.")

Even in the presence of a normal elbow it has been found that suture of the ulnar nerve with the line of suture in the region of the ulnar groove is less successful than if the nerve be transposed and sutured in front of the medial epicondyle. If carefully performed, transposition can be done without impairment of conductivity of the ulnar nerve.

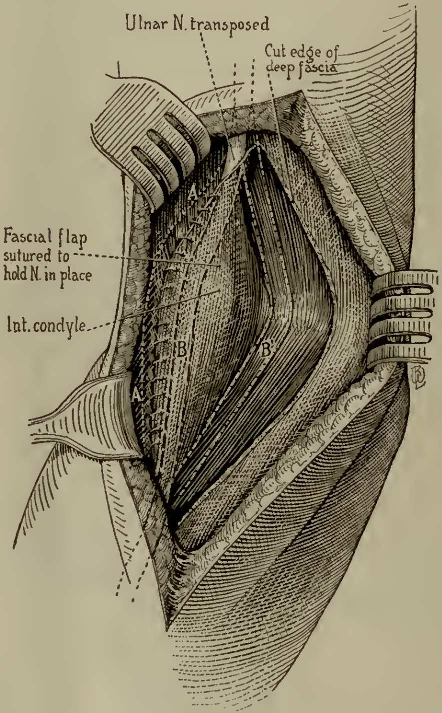

Fig. 217.—Ulnar nerve transposed in front of the condyle and held in its new position by flap of deep fascia over it. (From Stookey, "Surgical and Mechanical Treatment of Peripheral Nerves.")

Technic.—In transposition, two points of importance should be mentioned:

(1) Avoid any sharp angulation of the nerve either above, at the beginning of its new course, anteriorly, or below, where it enters the flexor carpi ulnaris muscle. Kinking and angulation must be prevented and is best done by extensive exposure, giving to the nerve a very gradual course forward.

(2) In the region of the elbow the branch to the flexor carpi ulnaris comes off and is endangered by transposition, but can usually be saved, though not always, by careful intraneural dissection, freeing the branch well up within the nerve trunk. If the branch is injured, reinnervation of the flexor carpi ulnaris can be obtained by direct implantation of the branch into the flexor carpi ulnaris muscle at a different level, or if the branch is destroyed at its origin from the nerve trunk, an artificial nerve branch may be formed and likewise implanted.

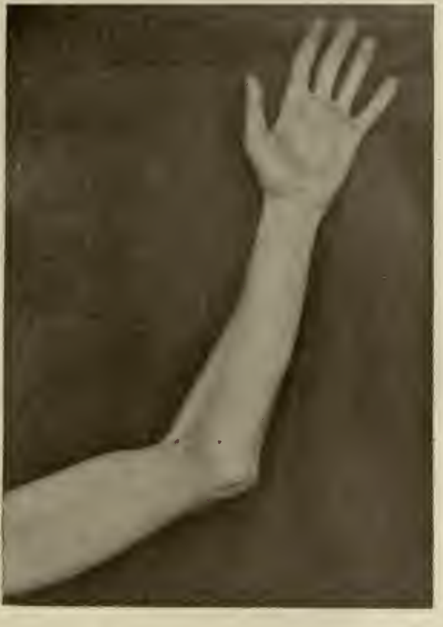

Fig. 218.—Photograph showing elbow and operative scar in second patient.

In order to hold the nerve in place in its ventral position two procedures are available:

(1) To resect a flap of the deep fascia and suture it over the nerve as shown in Figs. 216, 217.

(2) When the incision is made it should be carried through the skin and superficial fascia down to the deep fascia, and then peeled back by sharp dissection from the deep fascia so as to

undermine freely the anterior flap. The nerve may then be held in its ventral position by roughening the superficial and deep fascia *along the line to be sutured* and suturing it where roughened, leaving sufficient space unroughened to form a smooth natural canal between the superficial and deep fascia through which the nerve may glide readily.

Either method will be found satisfactory; the latter, being the simpler, and quite sufficient, may be preferred. This procedure was used in this patient.

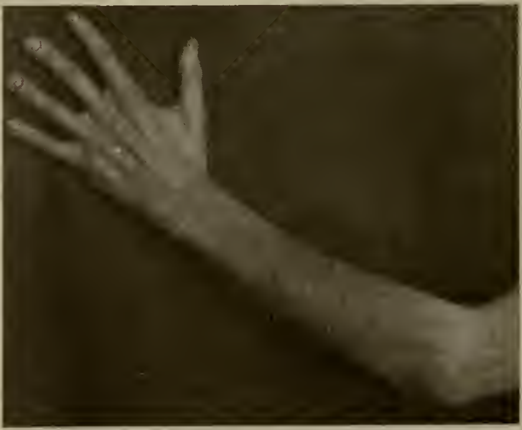

Fig. 219.—Photograph showing hand one and one-half years after operation. Intrinsic muscles show returning function, though some atrophy is still present.

Postoperative Report.—One and a half years after the operation patient shows beginning return of function in the hypothenar group of muscles and also in the interossei, that of the first space showing apparently more regeneration than the others. The electric reactions are now normal and the sensory examination shows only a slight impairment of cutaneous sensibility to tactile, pain, and temperature on the fifth finger, the rest of the hand having regained sensation.

CLINIC OF DR. C. J. MacGUIRE, Jr.

Bellevue Hospital

THREE SURGICAL PROBLEMS

Case I. Sarcoma of Tibia.
Case II. Traumatic, Hemorrhagic Nephritis.
Case III. Actinomycosis of Appendix.

Gentlemen, this morning I am going to discuss with you 3 very dissimilar cases, but all presenting unusual difficulties in diagnosis and treatment.

CASE I

The first case, Frances Z., a female aged forty-two, native of Austria, was admitted to Bellevue Hospital on December 1, 1919 with the following history:

Twelve years ago patient fell down a flight of stairs and was disabled for about three months, having to use a cane continuously in walking. Eleven years ago patient fell again on right knee, with resultant pain, tenderness, and swelling for one month. Eight years ago patient noticed a lump about 1 inch in diameter on inner side of knee, which was painful to touch. Six months later another lump formed on the opposite side of the knee. These two lumps grew very little until four years ago, when they slowly increased to the present size. For the past eight weeks she has been having burning pain over the lump. One week ago she noticed that veins over lump were very prominent; at times more than at others. For the past eight weeks she has had difficulty in bending knee and difficulty in walking. She has always been strong and healthy except for the present trouble.

Physical Examination.—There were no abnormalities or evidence of disease except in the local condition, which was as follows: Over the anterior and both lateral aspects of the head of the right tibia there was a very large mass continuous with the tibia, and bony hard except over the outer aspect. Here firm pressure caused a crunching as of a bony shell. The head of the fibula seemed involved in this mass. Near the center there was fluctuation and increased heat. The superficial veins were markedly distended. The Wassermann was negative. The accompanying photograph (Fig. 220) shows the size of the process, while the reproduction of the *x*-ray plate (Fig. 221) gives some idea of the bony changes. The *x*-ray department reported the plate as that of a giant-cell tumor of the tibia. The indications now seemed simple. Here was a slowly growing tumor of the bone of ten years' standing showing no tendency to form metastases, located in the head of the tibia, having a bony

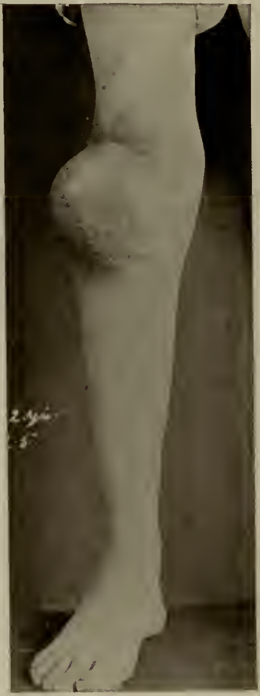

Fig. 220.—Appearance on admission.

capsule, and showing by x-ray the trabeculated appearance so typical of what we call giant-cell sarcoma of the bone. These tumors, according to Bloodgood, are benign, never metastasize, although they may recur locally, and the treatment is curettage of the bony cavity, chemical cauterization, and such other measures as may be necessary to guarantee a weight-bearing limb.

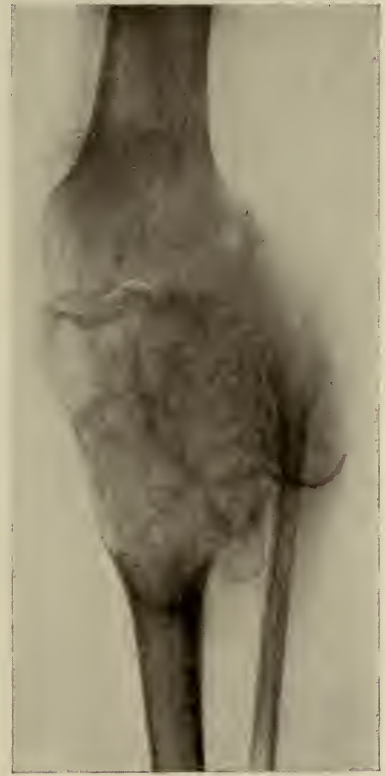

Fig. 221.—x-Ray of the tumor taken before first operation.

Therefore, on December 10, 1919 I made an incision over the outer surface of this mass, and found that the bony capsule at this site had ruptured and that the head of the tibia was the site of a large cavity divided into smaller cavities by trabeculæ of cortical bone and bounded internally only by a very thin shell of bone. The contents of this cavity consisted of old blood-clot, jelly-like granulations, and large areas of soft, yellow, fibrous tissue. The cavity connected directly with the medullary cavity of the tibia. This space was thoroughly curetted out, leaving superiorly only the articular cartilage as a roof; externally only the fibula and internally a thin shell of bone to support the weight of the body. Bleeding from the bone was controlled with great difficulty. A mass of subcutaneous fat was now removed from the anterior abdominal wall and dropped into the dead space in the head of the tibia. The anterior thin shell of bone was divided transversely with bone-cutting forceps and the two flaps broken back to help obliterate the cavity.

At this point our problem seemed mainly one of mechanics. It seemed doubtful that weight bearing could ever be possible without the danger of a pathologic fracture. The pathologic report, however, complicated the picture.

Macroscopic Examination.—Specimen consists of a large number of pieces of tissue, some of which are pieces of bone, others are mostly blood-clot, while still others consist of what appears to be tumor or connective tissue. The pieces of bone have a ragged appearance, and in places are covered with and seem to be infiltrated by a mass of tumor tissue. The tissue which seems to consist of blood-clot has a reddish color, is very soft, and has many areas in it which are somewhat the appearance of a part of a capsule or cyst wall to which is attached a rather soft, reddish mass, which is probably tumor tissue.

Microscopic Examination.—Sections taken from what appears to be blood-clot shows a rather cellular mass of connective tissue, hemorrhage, and tumor-cells. The tumor-cells in this vicinity consist of giant-cells, many of which are very large and contain as many as 15 or 20 nuclei. These are profusely scattered throughout this area. The other cells are rounded or ovoid, and close to the connective tissue they are of spindle shape. Near the junction of the tumor with the connective tissue there is a rim of newly developed bone. This bone contains a large amount of calcium salts, as is seen from the purplish stain. Sections taken from the dense tissue show the tumor cells to be almost entirely of spindle shape, and in these areas the number of giant-cells are relatively few. These cells lie on the surface of a rather dense mass of connective tissue. The tumor appears to be limited by this connective tissue, as the latter is only infiltrated for a short distance. Sections taken from the capsule which has broken through the bone shows the tumor tissue here to be made up entirely of spindle-cells. These cells resemble very closely those seen in a fibrosarcoma.

Diagnosis.—Sarcoma of mixed, spindle-, and giant-cells (myeloid sarcoma).

This was not a clear-cut picture of what is loosely called giant-cell sarcoma. In speaking of this tumor, as in practically all bone sarcomata, we are handicapped by the lack of a standardized nomenclature. It is evidenced by the various names given to this condition, *e. g.*, myeloma, epulis-type of tumor, osteosarcoma, bone-cyst, etc. The large spindle-cell element was alarming and caused us to subject a specimen to the judgment of other pathologists. These men all agreed that the picture was not typical, but that the proper procedure had been followed.

When the sutures were removed we found that the fat transplant had broken down, with consequent suppuration. Accordingly, the flap was lifted back and the cavity dakinized with Carrel tubes. This resulted in healthy granulations and about two and one-half months later we were contemplating some type of operation to obliterate the dead space when we discovered a rapidly growing red mass in the heart of the cavity and two nodules in the skin over the patella. These grew with astonishing rapidity, rapidly filling up the cavity. A section was taken and sent to the pathologist, who reported a histologic picture markedly different from that of the original tumor. This recurrence was made up almost entirely of spindle-shaped connective-tissue cells and many scattered spicules of recently developed bone.

The appearance of nodules in the soft parts combined with this rather alarming pathologic report seemed to indicate the advisability of amputation, and on March 16, 1920 the limb was removed at the junction of the lower and middle third of the femur.

Careful examination of the amputated limb (Fig. 222) showed the probable wisdom of this decision. Sections taken from the soft parts and the secondary nodules showed a mass of cells of the spindle type densely packed together and infiltrating the surrounding tissue with newly developed bone irregularly distributed throughout. Sections taken from the bone cavity show the typical arrangement that is associated with the giant-cell sarcoma of the medullary type. According to Bloodgood, there is no danger of metastasis in a giant-cell tumor, nor is the

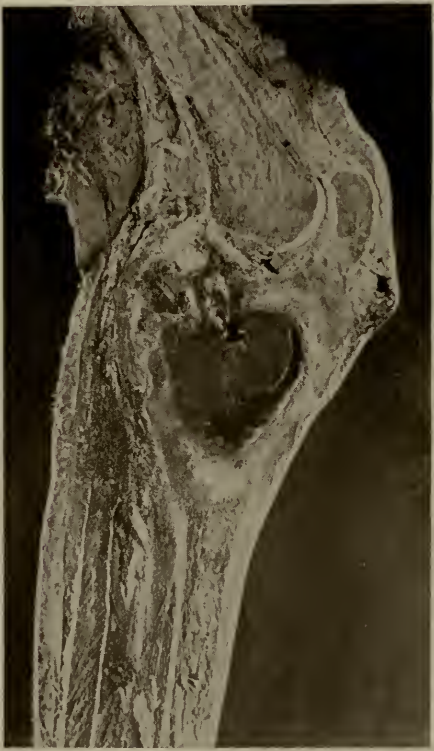

Fig. 222.—Sagittal section of amputated limb. Dark mass in cavity in head of tibia and smaller mass just below patella in soft parts represent recurrent tumor tissue.

prognosis affected by rupture of the bony capsule and infiltration of the soft parts. He also states that recurrences may occur locally, but should be treated by curettage. Here, however, we have a tumor in which rupture of the capsule and curettage had in some way caused the lighting up of an element previously dormant. This new element showed none of the histologic characteristics of giant-cell sarcoma or epulis type of tumor, and its rapid growth at some considerable distance from the original tumor seemed a marked indication of malignancy.

Dr. McWhorter, who examined these sections, was particularly struck by the formation of bone in the metastases in the soft parts. Although he did not attach great clinical significance to this element, it showed, he thought, how artificial is the classification of bone tumors into osteogenic and osteogenetic types. This tumor, apparently originally osteogenic, became osteogenetic.

Since the last operation, almost three years ago, the patient made an uneventful convalescence, is walking around on an artificial limb, and as yet shows no evidence of metastasis (*x*-rays of lungs being negative), but one cannot feel safe until the five-year period has passed. There is no doubt as to the permanent cure produced by following Bloodgood's method in treating the usual sarcomata of the epulis type, but this case, I believe, indicates the existence of another type clinically indistinguishable which has not yet been classified and in which it would be very dangerous to follow any didactic rules.

Sarcomata of the bone other than those of the epulis type are associated with early metastases to the lung in the majority of cases irrespective of amputation. However, we do not feel that the possibility of a small intermediate class has been ruled out, and fear that indiscriminate curettage may lead to bad results in cases whose only hope lies in amputation.

This case has been distinguished not only by the difficulty in determining the proper surgical procedure but also by difficulty in finding the proper pathologic classification. In collaboration with our pathologist, Dr. John E. McWhorter, we have made an analysis of cases of sarcoma of the long bones on the First Surgical Division of Bellevue Hospital, and are reserving our final conclusions until the five-year follow-up period determines the final outcome, but in the meanwhile we feel the necessity of emphasizing the difficulties of discussion where no standardized nomenclature exists. Dr. Codman's Central Registry in Boston is the best answer to this problem, and our material is being assembled for use there. We feel also that neither pathologic section nor *x*-ray furnish absolute basis for prognosis.

CASE II

The next case, although of an entirely different type, is also one that presented unusual difficulties as to procedure. The patient, a young woman of twenty-three, was admitted to St. Vincent's Hospital on December 27, 1921, with the following history:

Three weeks ago patient was struck by a motor truck in the right side and knocked to the ground. She was taken home suffering from pain and difficulty in breathing, and it was discovered that the tenth and eleventh ribs on the right side posteriorly had been fractured. She stayed in bed for eight days, and on the tenth day while at stool she was seized with sudden excruciating pain in the right lumbar region, with occasional radiation to the right groin and pubis. Within an hour she passed considerable bright red blood and a few clots apparently per urethram. The hematuria and blood-clots continued for the next four days and were accompanied by frequent attacks of vomiting and abdominal distention. On the fifteenth day the urine again became quite clear. Two days later there was again a sudden attack of pain, with a repetition of the symptoms above. This subsided in three days and was followed by a three-day interval of clear urine and freedom from pain, and then, in turn, another recurrence.

On admission, urine was bloody, but did not contain clots. During the attacks of hematuria a large chamber would be filled with clots and what looked like pure blood. Hemoglobin was 55 per cent., red blood-cells 3,600,000, blood-platelets 310,000, coagulation time was four and one-half minutes, white blood-cells

7800, polymorphonuclears 77 per cent. Temperature was 99° F., pulse 116, and respirations 24. Urine was dark amber, reaction acid, specific gravity 1022, albumin a trace, guaiac positive, leukocytes a few, and many red blood-cells.

Physical examination showed the patient appearing anemic with a recent loss of blood, otherwise well nourished and healthy. There was moderate rigidity on the right side of the abdomen, but no mass or induration. The rest of the physical examination was entirely negative.

At this point the striking features of the case have been the interval of ten days between the trauma on the right side, the onset of hematuria, the periodic cessation and recurrence of the attacks even though the patient had been confined to bed from the onset of the hematuria, and the enormous clots passed per urethram. In view of the absence of frank blood in the urine on admission and the apparent subsidence of the process absolute rest in bed seemed the only indication. Twenty-four hours later, without apparent cause, pure blood accompanied by large clots were again passed. This was associated with marked aggravation of the patient's anemia, so that we felt that a further loss of blood would jeopardize her life. Constitutional causes for the bleeding seemed to have been eliminated. The coagulation time was normal and there was no history of any hemophilic tendency.

Dr. E. L. Keyes, Jr., was consulted, and performed a cystoscopy. The bladder was found clear with the exception of a blood-clot protruding from and apparently plugging the right urethral orifice. The left ureter admitted a catheter and was apparently functioning normally. At this point an exposure of the right kidney was determined upon.

The usual lumbar incision was made, and upon exposure of the right kidney there was found no evidence of rupture of the kidney capsule and no evidence of perirenal hemorrhage or extravasation. The ureter and pelvis, however, were markedly distended with blood-clot and fluid blood. A decision had now to be made on either a radical or conservative procedure, and the former was decided upon, because it was felt that a further loss of blood was incompatible with safety, and that nephrectomy was our only sure method of control. Nephrectomy was accordingly done, and the kidney, after removal, immediately opened. The calices were found filled with large, unorganized blood-clot. The upper pole was scarred and showed some perinephritic adhesions and an underlying area in the cortex which appeared pale and degenerated, but no actual sloughing. It was felt that here in the upper pole there was probably a ruptured blood-vessel which periodically clotted with subsequent loosening of the clot whenever the kidney resumed function (Figs. 223 and 224).

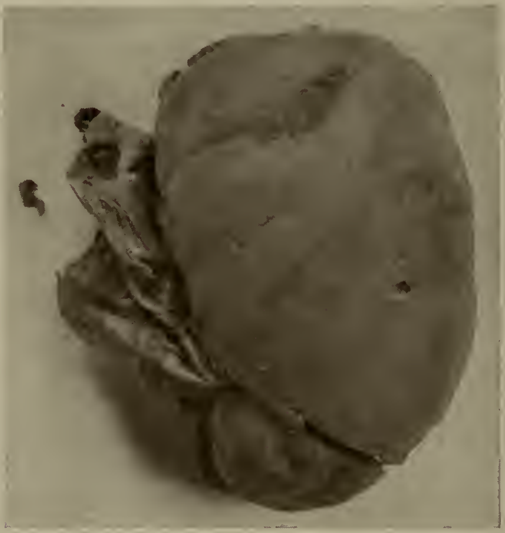

Fig. 223.—Photograph of kidney after removal showing outer surface intact except where section had been removed for microscopic examination.

The kidney was sent to Dr. A. Fraser, Professor of Pathology at Bellevue Hospital, and he returned the following report: Kidney shows scar encircling the upper pole, the parenchyma above this is hemorrhagic and atrophied, showing a nodular surface. A second similar, deep, irregular scar is seen on the under surface of lower pole and extending into the pelvis, but not involving the ureter. The parenchyma here is in the same condition as that of the upper pole. The pelvis and calices are markedly distended and show some adherent blood-crusts. Histologically the scarred areas show fibrosis replacement of parenchyma, with surrounding hemorrhages into glomeruli and tubules, and in some areas into stroma. Diagnosis: traumatic, hemorrhagic nephritis.

The patient had an uneventful convalescence and was recently seen at a date about one year after her operation, and has apparently accommodated herself satisfactorily to the loss of her kidney.

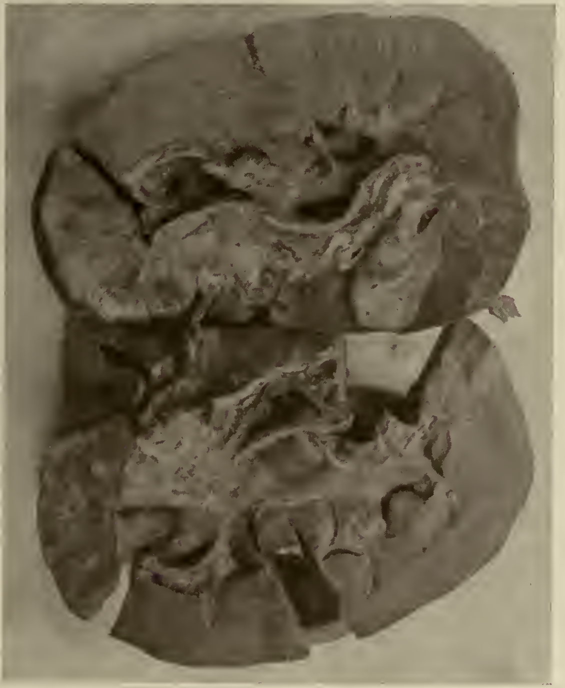

Fig. 224.—Photograph of kidney after splitting it to show cortex free from any gross deformity except where the tissue sections have been removed for microscopic study.

This is, I believe, a very unusual clinical picture, and after discussion with many other surgeons I have failed to make an altogether satisfactory explanation of the sequence of events. There seems little doubt that the cessation of hemorrhage must have coincided with the temporary cessation of kidney function and that the recurrence of hemorrhages coincided with the resumption of kidney function, with each time a resulting hemorrhage that would be fully as large as the previous one. What was the original picture within the kidney permitting a ten-day interval before the onset of the first hematuria and then leading to the ultimate discovery of a kidney showing no immediate extracapsular involvement?

There have been some similar cases reported in the literature, 2 of which seem rather pertinent. The first is from Guy's Hospital Reports, London, 1892, in which Mr. Reeves reported a case. A boy of nineteen fell from a cart and injured the right kidney. For nine days there was very slight hematuria, but then almost pure blood was passed. Death at the end of the fourth week. Autopsy showed right kidney broken down to pulp, with a false aneurysm of the renal artery. This case clinically resembled ours, but the pathology is, of course, quite different.

Another case reported in St. Thomas' Hospital Reports is as follows: A boy of fourteen was kicked by a horse in the region of the right kidney. There was no hematuria at the time, but one week later severe pain, vomiting, and hematuria developed. This recurred at intervals. A nephrectomy done fifteen years later showed a calcified hematoma of the lower pole, with a layer of kidney substance spread over it.

Had it been possible to control our case without nephrectomy the final pathology might have corresponded to that in the last report. On the other hand, it must be borne in mind that the ureter can become permanently plugged with blood-clot leading to atrophy and breaking down of the kidney.

For co-operation and advice in determining the right procedure in this case I was deeply indebted to Dr. E. L. Keyes, Jr.

CASE III

The next case is brought up for discussion, not to demonstrate any new features in diagnosis or treatment, but simply as an example of the clinical course of a complicated abdominal condition not often encountered in the ordinary surgical practice. The patient, H. M., an Irish woman, thirty-four years of age, was admitted to St. Vincent's Hospital on May 16, 1920. I had seen her in my office about six weeks previously, and at that time she gave a history of attacks of cramp-like pains in the lower central abdomen on four different occasions at indefinite intervals during the past year. The first attack had been accompanied by vomiting and confinement to bed for two or three days. Subsequent attacks had been milder, without vomiting or any relation to meals; bowels regular. Her past history was one of uninterrupted good health. She came from Ireland ten years ago and had never left the vicinity of New York. One week before admission she had her last attack, and in this the central abdominal pain was followed by localization in the right lower quadrant. On physical examination persistent and well-localized tenderness was elicited beneath McBurney's point. No mass could be felt. In every other way she seemed a woman in robust health. A diagnosis of chronic appendicitis was made.

Operation was performed on May 17th, and the appendix removed through a McBurney incision. It was found bound down by adhesions, retrocecal in position, with its distal half showing a much thickened wall and buried behind the ascending colon. It was delivered with some difficulty. The cecum appeared normal in every way and the base of the appendix was inverted beneath a purse-string suture without difficulty. The abdominal wall was closed without any suspicion that we had been dealing with any other condition than a chronic appendicitis with recurrent acute attacks. Upon removing the sutures on the seventh day I discovered a rather deep mural abscess, which was opened and drained, with the discharge of colon-smelling pus. During this first week there had been a persistent febrile reaction averaging about 100° F. From this point on and through the next three months there was a persistently increasing temperature reaction of the septic type, with afternoon rises reaching finally to 105° F. and morning remissions almost to normal. On the seventeenth day a mass could be felt apparently in the muscle of the right flank, and because of this and increasing sepsis the operative wound was reopened. Induration and serosanguinous discharge was found along a tract leading down into the right iliac fossa. Rubber tube drains were inserted. This led to no improvement, and a few days later the picture was complicated by the formation of a fecal fistula. The responsibility for this was erroneously put on the drainage-tubes. From this period on the picture was one of successive areas of induration in the right groin, the right flank, the right perinephritic space, and finally in the right costophrenic sinus. They were all characterized by marked induration, lack of tenderness or pain, and a very moderate amount of suppuration. They were all opened widely, and in the case of the costophrenic sinus a partial resection of the tenth rib was done. Wherever incisions were made chronic fistulæ formed, with rather thin, foul, grayish discharge, and the operative procedures always tended to aggravate rather than relieve the sepsis. The first fecal fistula closed up spontaneously, but a second one formed just to the right of the umbilicus. Up to this point a diagnosis had not been made. Smears had revealed colon bacilli and various contaminating organisms, but no actinomyces. Repeated blood-cultures were all sterile. The blood-count varied between 14,000 and 26,000, with the polymorphonuclear count averaging about 83 per cent. Subjectively, the patient was cheerful, had a good appetite, and no complaints except at the operative procedures, the consequent soreness in her right side, and occasional attacks of diarrhea. There was surprising freedom from pain. Because of the tendency to sinus formation it was suspected that a foreign body such as a gauze sponge might have been left in the abdominal cavity, so the fistulæ were irrigated for several days with collargol and then x-rayed, but no foreign body was revealed.

A liver abscess was now suspected, and this suspicion was confirmed by an x-ray which showed the right diaphragm to be elevated and fixed. Exploration of the already existing sinus in the tenth interspace led us into a large abscess replacing about half of the right lobe of the liver, and smears from this were sent to Dr. Fraser of Bellevue University, who made the following report: "The specimen shows numerous colonies of Actinomyces bovis surrounded by granulomatous reaction characteristic of actinomycosis." This immediately made the whole picture quite clear, but too late to have the therapeutic indications prove of any avail, and the patient died of sepsis and exhaustion just four months after the original operation (Fig. 225).

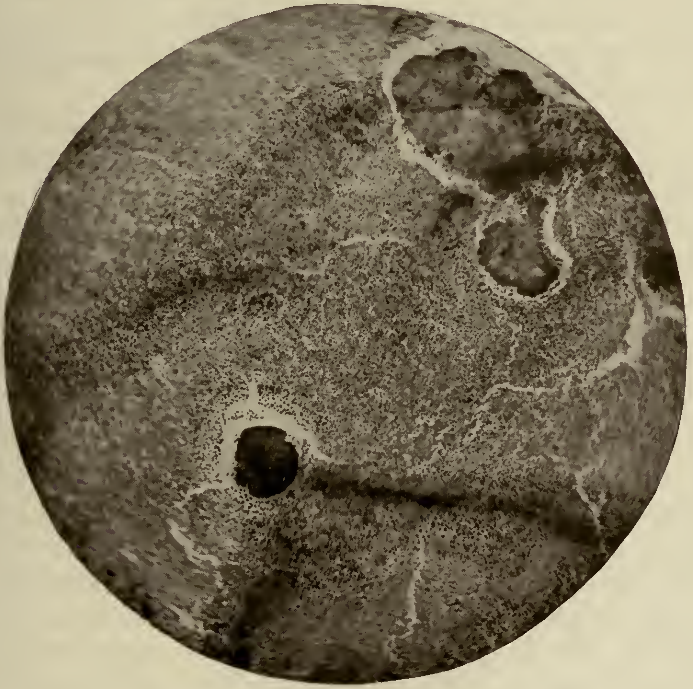

Fig. 225.—Low-power smear from liver abscess showing actinomycotic colonies.

Undoubtedly the original focus was the appendix, and had no operation been done, the disease might have remained dormant for some time.

A review of the literature indicates that, as a rule, these cases are either operated on early, as was this under the diagnosis of chronic appendicitis, or if left alone go on to the formation of a large actinomycotic mass involving the neighboring viscera, and always advancing by direct extension disregarding anatomic barriers. The treatment has always been unsatisfactory and until recently was confined to very large doses of potassium iodid by mouth and iodin locally. Some success in the treatment of actinomycosis by x-ray has recently been reported. Incison and drainage in abdominal actinomycosis has not been found to be of benefit, and this was well demonstrated in our case in which the process had been invariably aggravated by this procedure. Some operators report success with wide excision of the entire diseased area, but this procedure has, of course, its limitations in abdominal actinomycosis.

In conclusion, let me emphasize for you again those features so well brought out originally by Dr. John B. Murphy, who published in 1885 the first case of actinomycosis hominis recognized in this country. There is an ache rather than a pain. The infiltration in the iliac fossa is slow and very hard, and the process tends to extend through the abdominal wall, and when it does, yellow, sulphur-like granules are discharged, and these are pathognomic. Actual suppuration is due to mixed infection. The disease spreads by direct extension and never by the lymphatics. In our case it will be noted the spread was around the kidney to the diaphram and directly into the liver. The course is chronic and marked by sepsis, and where the disease is suspected, repeated daily smears must be made in the search for the actinomyces or ray fungi, as these are not easily found. The treatment medically is potassium iodid in massive doses, copper sulphate, and iodin locally. Surgically, the treatment is wide excision where feasible. Some benefit has been reported from x-ray where the disease is superficial.

CLINIC OF DR. ELMER P. WEIGEL

New York Post-Graduate Medical School

FRACTURE OF FLOOR OF ACETABULUM

The first case is one of a young woman aged thirty-five, school-teacher, who while riding on the right rear seat of a light automobile was hit by a heavy car as it skidded about a corner, on the wet pavement, in such a manner that the weight of the blow struck her just over the region of the right hip. She was unable to walk and was taken home in another car. After an examination by her physician, it was evident that she had sustained a serious injury to her hip. She was sent to an x-ray laboratory for examination, and with these x-rays she was admitted to the hospital and came under my care.

Upon examination I found a young woman of slight build, normal in every way, except for the injury to her hip, which seemed to be very painful, for she complained severely on the slightest movement. The right foot was somewhat everted and the leg was held in a position of abduction. Upon careful examination flexion at the hip seemed to be quite free, and also a limited amount of rotation could be demonstrated without increasing her pain; but when abduction or adduction was attempted she complained severely and practically no motion could be demonstrated. Measurements from the anterior superior spine to the internal malleolus showed $\frac{3}{4}$ inch shortening on the right side. There was no crepitus noted during the examination, but rather a peculiar sense of resistance to any motion. There was also a distinctly tender spot over the pubis on the right side. Temperature, pulse, and respirations were normal. Routine blood and urinary examinations were also negative. An examination of the x-rays showed that there had been a fracture of the floor of the acetabulum in which the head of the femur had been driven through, so that it encroached upon the lumen of the pelvis to about one-half the diameter of the head. There was no fracture of the femur. There was also a fracture of the ilium running from the acetabulum up to the free border, as well as a fracture of the superior and inferior rhamni of the pubis anteriorly. In fact, the appearance was one of a completely free fragment from the acetabulum behind to the fracture of the pubis anteriorly (Fig. 226).

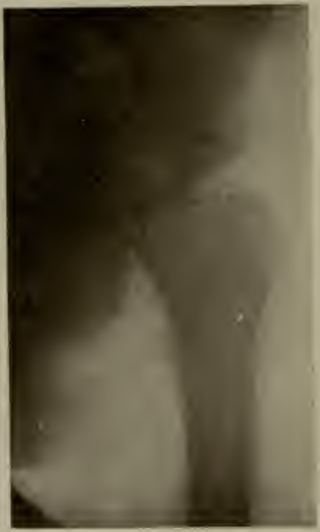

Fig. 226.—*x*-Ray immediately after injury, showing fracture of acetabulum with head driven into pelvis.

The patient was taken to the operating-room, completely anesthetized, and fastened into the Albee fracture table. The center of the leg traction bars were set at a point outside the patient's hips and traction was applied in the vertical position. Then the right leg was strongly abducted so as to pry the head of the femur out of the pelvis by using the great trochanter as the fulcrum of a lever against the side of the pelvis. At the same time the traction became increased because the center of the traction bars were set at a point outside the patient's hips.

With the limb in complete abduction a plaster-of-Paris spica was applied from the toes to the costal margin (Fig. 227). The plaster was allowed to remain on for a period of two months' time. *x*-Rays taken through the cast showed the head of the femur practically in its normal position as far as its relation to the acetabulum was concerned, but the fragments of the floor of the acetabulum remained driven in.

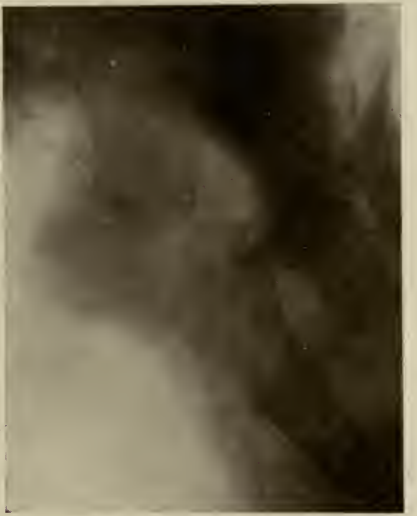

Fig. 227.—*x*-Ray taken through cast, with leg in marked abduction showing the head of femur pulled almost entirely out of pelvis by use of marked abduction and traction in the fracture orthopedic table.

When the plaster was removed the patient had some motion in all directions, but there was, of course, some stiffness due to the long fixation. Massage and manipulation were instituted. She was able to get about on crutches, bearing some weight on the leg, and soon learned to walk quite well.

Six months after the injury the patient was walking without crutch or cane, and only with a slight limp. There was practically no actual shortening of the leg, but rather an apparent lengthening due to the fact that a slight amount of the abduction had persisted. All motions of the hip were present, but limited about

50 per cent. *x*-Ray showed a liberal callous formation about the acetabulum, and this projected considerably into the pelvis.

This case is very interesting for several reasons. First, because of the unusual way in which the force was applied to drive the head of the bone through the acetabulum and fracture the ilium above and the pubis in front, and yet, at the same time, not fracture the femur itself or cause any serious injury to the interpelvic organs.

Second, it was an ideal case for the use of the Albee fracture table, and I doubt very much if we would have been able to get it in as satisfactory position without the table. I feel that ordinary traction out straight would simply have locked the head more firmly behind the fragments of the ilium, the head having slipped through and the fragments having encroached upon the neck. By using the table we were able to get the combined action of traction and the leverage action of the abduction, and at the same time having the traction increase with the abduction.

Third, in spite of this extensive fracture there was no damage to the pelvic viscera, as would have been manifested by bloody urine, or pain, or discomfort of any sort. The encroachment on the pelvic inlet was such that we considered it advisable to caution the patient against the possible interference with future delivery should she become pregnant.

COMPRESSION FRACTURE OF SPINE

C. M. A man thirty-eight years of age, working as a lineman for the telephone company. In June, 1921 he fell from a pole the distance of 30 feet. He landed on his feet, and the weight of a heavy kit of tools which he had strapped to his shoulders, together with the impact of the fall, caused him to double up so that his head was "between his legs," as he described it. He was removed to a hospital in an ambulance, where he was carefully examined and kept in bed for one week. No fractures were found and, except for a few bruises, he was thought to have escaped without serious injury. At the end of the week, the greater part of the shock having subsided, he was taken home and allowed to start walking about. This he did with some difficulty and the aid of a pair of crutches. He complained severely of the pain in the lower part of his back, and radiating down both legs to the knees. This was particularly severe on the right side. He received baking and massage to his back and legs, but, except for the immediate effect of the sense of well-being, he was not relieved. His spine was then *x*-rayed and pronounced normal. An *x*-ray of his teeth was taken, and several suspicious ones were removed. His tonsils were inspected and treated, but to no avail. On several occasions his back was strapped with adhesive plaster, but this did not relieve him.

He came under my care in March, 1922, a man much broken in spirit and despairing that any real help might be obtained. He walked with two canes, and I noticed as he entered the office that he was very careful to avoid any jars or missteps. He took a straight-back chair, and as he sat down he lowered his weight with his hands. He complained of severe pain in the lower part of his spine whenever he was on his feet, and said that he only found relief when flat on his back in bed.

Upon examination, I found a well-developed man of medium stature, with a well-nourished musculature which had become somewhat softened from months of non-use. Head, chest, and extremities were negative. He held his spine rigid, particularly the lower half. There was pronounced muscle spasm present in this area. In flexing and extending his spine he seemed to bend rather from the hips than from the spine itself. All these motions were accompanied by a great deal of pain. Motion of the hips was free, but when the hips were flexed with the knees extended he complained severely of the pain in his back. No kyphosis was present, but there was a peculiar fulness in the lumbar region which rather suggested an obliteration of the normal lordosis. He was *x*-rayed stereoscopically and with

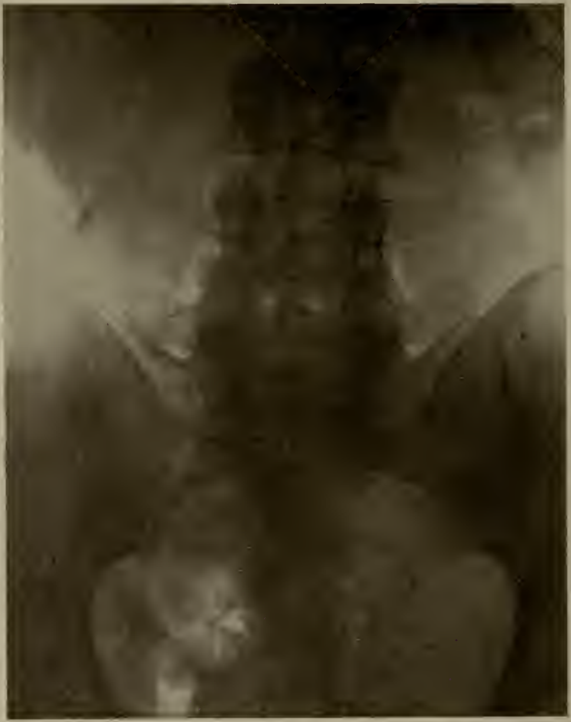

Fig. 228.—*x*-Ray showing compression fracture of the body of the fifth lumbar vertebra.

the Buckey diaphragm. These x-rays showed a partial destruction (Fig. 228) of the body of the fifth lumbar vertebra and the intervertebral disk between it and the fourth lumbar vertebra. There was also some proliferation of new bone growth in this region.

I decided to immobilize the spine by a bone-graft. We feel that this is the treatment of choice in any case of compression fracture of the spine without paralysis. The location of the fracture in this case made it additionally necessary to resort to this treatment, inasmuch as it is absolutely impossible to get adequate fixation of the lower lumbar spine by external methods unless the fixation dressing include both thighs.

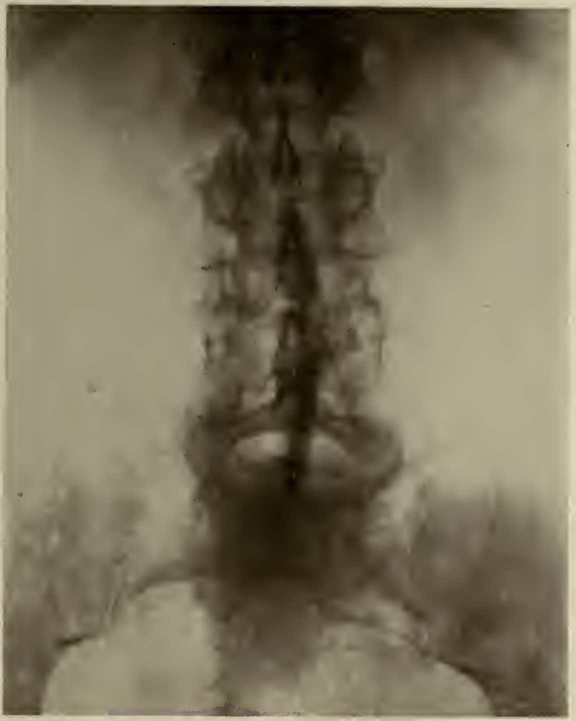

Fig. 229.—x-Ray taken one year after bone-graft from tibia was placed in spine.

The patient was admitted to the hospital, and under gas-ether anesthesia a graft taken from the crest of the left tibia was placed into the spines of the lower lumbar vertebræ by the usual technic, as recommended by Dr. Albee, using the motor saw. The lower end of the graft was cut wedge shape and driven into a tunnel made in the sacrum. The graft extended up as far as the third lumbar vertebra. The fascia was drawn together over the graft with medium kangaroo tendon and the skin was closed with plain catgut. No plaster cast was applied. The patient was kept flat on his back in bed on a fracture mattress for six weeks. Both the wound in his back and the one in his leg healed readily. At the end of this time he was allowed up gradually, and left the hospital, using a cane at the end of the eighth week.

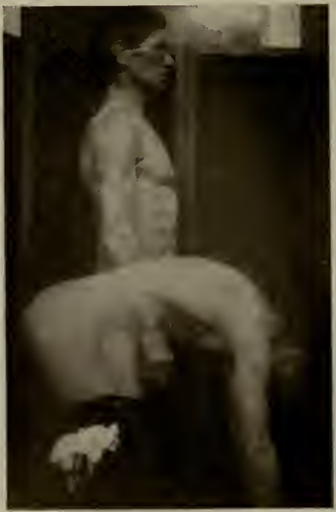

Fig. 230.—Photograph showing the amount of motion of spine above and below graft. Notice the rigidity of the lower lumbar spine.

Two weeks later he discarded his cane and began walking a quarter of a mile a day, and gradually increased this until he could walk three miles without tiring. His former pain had left him, and at the end of four months he went back to his former work, which he could now do without pain or discomfort. x-Rays of his spine taken one year after the operation show the graft in place with considerable callus about it (Figs. 229, 230).

JOINT MOUSE IN KNEE WITH FRACTURE OF EXTERNAL CONDYLE OF FEMUR.

D. J., male adult, thirty years of age, presented himself for treatment complaining of pain and inability to completely extend his right knee. He had had trouble for some time, but the acute symptoms date back three weeks. For the past three or four years he has had trouble with this knee. There is no history of injury, but a gradual onset of pain, swelling, and general weakness, and at times a feeling of something "slipping around" in the knee-joint. There has been a great deal of grating and cracking in the joint, but patient gives no history of any distinct locking. Sometimes while walking he would feel something slip in the joint, and these attacks would cause pain and invariably be followed by swelling which lasted for several days. Patient does not remember that these attacks were ever such that knee became locked and could not be extended. However, these symptoms were such that he realized this knee to be weaker than the left one, and he took great pains to guard it from injury. He wore an elastic knee-cap. No other joints showed any symptoms, and other than this he was perfectly healthy.

Three weeks before he came under my care, while playing tennis, he leaned over to the right side to get a low ball and felt something give way in his knee-joint. He fell to the ground and the pain was very sharp and acute. He was carried from the court and taken home, where he remained in bed. The following day the knee was swollen and very tender and could not be straightened out. This condition persisted, and, except for a diminution of the swelling, remained this way until I saw him three weeks later. In the meantime he received baking, massage, and the application of several types of liniment, and also had the knee strapped with adhesive plaster.

When I saw him he was walking on crutches, bearing no weight on that leg. The knee was slightly swollen and distinctly tender over both sides of the patellar tendon. The extension was limited by about 20 degrees, and attempts to straighten the leg caused great pain (Fig. 231). The *x*-rays showed two distinct foreign bodies in the joint, which appeared to be smooth and looked as if they were free in the joint. The *x*-rays also showed a certain amount of joint distention from the fluid. I made a diagnosis of foreign bodies (joint mice) in the joint, and advised operation to remove them. I felt that these had undoubtedly been there for some time, and the acute pain that came on while he was playing tennis was one being caught between the condyles and the tibia.

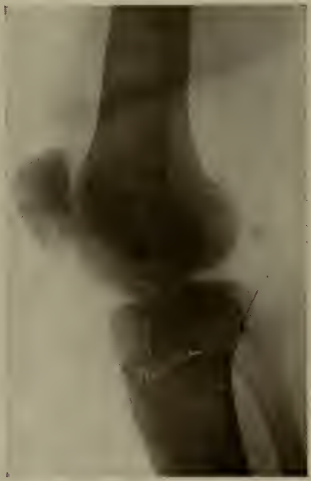

Fig. 231.—*x*-Ray showing pedunculated joint mouse in front of the crucial ligaments, and just above it foreign body which proved to be fragment of cartilage from condyle of femur.

The patient consented to the operation and was admitted to the hospital. In opening this knee-joint I decided to use the split patellar incision because the history was by no means definite, and one could not feel any too sure about the diagnosis or the location of the foreign bodies. I feel in these cases where it may become necessary to explore the whole joint the split patella incision, as recommended by Sir Robert Jones, is the one of choice because it makes all parts of the joint accessible without in any way damaging the knee-joint itself. The patella was split with the motor saw and the quadriceps and the patellar tendons were severed longitudinally with the knife. As the joint was opened there shot up into the incision a small white glistening foreign body, the size of a pea, and firmly attached by a pedicle to a position between the condyles of the femur. I felt sure that this was the cause of the trouble, but decided to explore the joint thoroughly, and upon flexing the knee found just behind the external condyle a piece of joint cartilage about the size of the thumb-nail and $\frac{1}{4}$ inch in thickness. Directly above this upon the external condyle of the femur was a punched-out depression from which the piece of cartilage had become separated. This piece of cartilage was so wedged between the tibia and the femur that it prevented the complete extension of the joint, but as soon as it was removed this tension became relieved and the leg could again be extended. Further investigation revealed nothing more abnormal, and the wound was closed in layers, being careful not to leave any openings into the

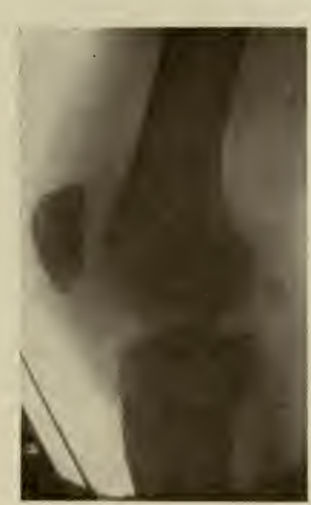

Fig. 232.—*x*-Ray of knee, showing condition after removal of joint mouse and fracture fragment of condyle.

joint cavity. The tendon just above and below the patella was held with a stitch of kangaroo tendon. The skin was closed with plain catgut, and a posterior plaster splint was applied for a period of two weeks. At the end of this time the dressing was changed and the wound had healed by first intention. The splint was then removed and the patient encouraged to bend the knee. He received massage and manipulation daily. At the end of three weeks the patient left the hospital, the knee feeling much better, and the tenderness having entirely disappeared. He could now completely extend the right knee.

At the end of two months the patient was walking without any support and feeling entirely cured (Fig. 232).

This case is of particular interest because it shows the wisdom of using the split-patella incision in all knee cases where one may have occasion to examine the whole joint. If we had made a lateral incision in this case it would have been very difficult to remove the pedunculated joint mouse, and we never would have discovered the broken fragment of cartilage behind the external condyle.

This incision enables us to explore the whole joint thoroughly without doing any permanent damage to the joint itself.

FRACTURE OF TIBIA WITH LOSS OF SUBSTANCE

T. R. T., a male adult aged fifty, was struck in the right leg by a heavy plank while working as a carpenter. He sustained a compound fracture of the tibia at the junction of the middle and the lower third. There also was a simple fracture of the fibula in the upper third. The patient was taken to the hospital and was operated upon by his doctor to remove some loose pieces of bone. A splint was then applied, and the wound was dressed daily. While there was a good deal of granulation tissue formed, the bone did not entirely cover over, and continued to discharge. Several attempts to overcome this were made by scraping the bone, but the sinuses were obstinate and continued to discharge. After six months of this kind of treatment had gone on and the leg was still not healed the patient decided to change physicians and was taken to another hospital. The surgeon who now had charge of the case decided to remove the whole thickness of the bone because of the existing infection, and, consequently, took out 3 inches of the tibia, cutting the shaft entirely through, above and below, with a saw (Fig. 223). About three months after this operation the wound stopped draining and became healed. There was, of course, no union present, and it was necessary for the patient to use crutches.

Shortly after this the case came under my care. There was a frank non-union of the tibia, with about 3 inches of loss of substance. There was still a small scab on the wound, and when this was removed I found a small sinus that led to a little piece of sequestrated bone in the soft parts. This was removed and the wound healed quite promptly. Due to poor fixation early in the treatment of the case the fracture at the upper end of the fibula became malunited in such a manner as to cause a bow-leg deformity of the leg. I recommended that the loss of substance of the tibia be replaced by a bone-graft from the other tibia. However, I felt that it would not be wise to do this until the leg had remained healed for at least two months, so as to prevent, as far as possible, any chance of stirring up the old infection.

After about ten weeks' time I performed this operation. A curved incision was made over the inner side of the tibia and a flap of skin dissected down to the periosteum. With the twin saw a gutter was cut in each fragment for the distance of about 2 inches. The ends were cut off with the small saw and these two fragments were removed. Great care was taken to be sure that sclerosed ends of the tibia adjoining the gap were sufficiently removed in the line of the gutter so as to allow the graft to come easily in contact with the marrow substance of each fragment. Two holes were then drilled in each fragment and kangaroo sutures passed through. The measure and pattern of the required graft was then taken with a flexible probe. The other

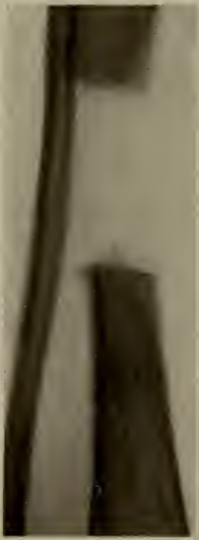
Fig. 233.

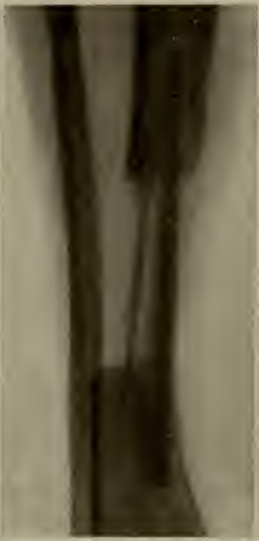
Fig. 234.

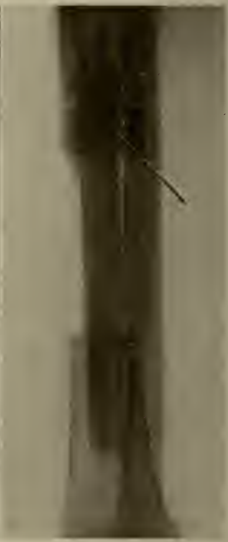
Fig. 235.

Fig. 233.—*x*-Ray showing extensive loss of tibia just after leg has healed.

Fig. 234.—*x*-Ray showing grafts in place after ten weeks' time. Notice proliferation of bone about sliver graft.

Fig. 235.—Lateral view, same leg.

tibia was incised similarly, and with a twin saw, in which the blades were set slightly farther apart than those in the first one used, a graft of the required length was cut from over the marrow cavity. By cutting the graft with a saw of somewhat wider gage the graft fits snugly into the gutter. The loops of kangaroo tendon were now lifted out of the gutter and the graft passed beneath them and fitted into its bed. The tendons were now tied over the top of the graft to hold it securely in the gutter.

An additional very narrow "sliver graft" was then cut from the left tibia just alongside of where the main graft was taken, and this was also placed beneath the kangaroo tendons to add some additional bone-growing surface. The wounds were then closed with plain catgut and a circular cast applied to the right leg from the toes to the groin. This was allowed to remain for ten weeks, and when it was removed the leg was solid (Figs. 234, 235). An *x*-ray was taken which showed the two grafts in place and both proliferating bone. The patient was then allowed to begin bearing weight gradually.

This case demonstrated a mistake which is frequently made, namely, the removal of too much bone in an effort to cure an osteomyelitis. It is always necessary to remove enough bone to allow the soft parts to fall into place, but rarely is it necessary in doing this to remove the whole shaft of the bone and in that way break the continuity. If the bone is removed in such a way as to create sloping walls out of overhanging ones it will usually be possible to get the wound to heal and yet not break the continuity of the bone.

CLINIC OF DR. RICHARD LEWISOHN

Mount Sinai Hospital

INFLAMMATORY TUMORS OF THE OMENTUM

Comparative Frequency of Postappendicular Omental Infections and of Torsion of the Omentum. Rarity of So-called Primary Inflammatory Tumors of the Omentum. Report of Two Cases. Etiology. Differential Diagnosis. Pathology.

Inflammatory tumors of the omentum secondary to abdominal operations are by no means rare. For instance, they are not uncommonly encountered in the postoperative course of a gangrenous appendicitis with general peritonitis. Infections of the peritoneal cavity may develop omental tumors with one or more abscesses which are frequently surrounded by inflamed omentum.

Furthermore, omental tumors of considerable size are sometimes encountered following operations for hernia (inguinal, femoral, umbilical, etc.). In spite of the absence of infection large tumors are formed which may cause intestinal obstruction. Their etiology is not quite clear. However, it is very probable that following the hernia operation a small part of the omentum becomes adherent at the site of the operation. This attachment interferes with the motility of the omentum. A portion of the omentum being fixed, the omentum is apt to twist on its longitudinal axis (so-called torsion of the omentum). Further sequelæ may be gangrene of the omentum or intestinal obstruction.

In contrast to these two types of omental tumors caused by peritoneal infection or a mechanical abnormality the primary inflammatory tumors of the omentum are extremely rare.

Before discussing etiology and pathology of these tumors I wish to present to you 2 cases belonging to this group.

CASE I

The first patient, D. S., aged fifty-three, admitted May 15, 1922.

Previous History.—The patient developed pain in the right lumbar region about nine months ago. This pain lasted for three months. The pain then shifted to the right lower quadrant, where it still persists. It is dull in character and has no relation to meals. No vomiting, no sour eructations. Patient has lost 12 pounds in six weeks.

Status.—The patient is rather anemic. Heart and lungs are normal. In the right lower quadrant opposite the umbilicus a hard oval mass is palpable. This mass is nodular and about 8 cm. in diameter. It does not move with respirations. The mass is slightly tender on palpation. Rectal examination is negative.

***x*-Ray examination** of the colon with the aid of a barium enema shows a marked distention of the rectum and redundancy of the sigmoid. There is spasticity of the transverse and descending colon and an apparently persistent defect in the caput coli. It is difficult to state whether the latter is due to a new growth or only to spasm.

The cachectic appearance of this patient, his age, his loss of weight, the character of the mass, and the *x*-ray defect in the caput coli suggested carcinoma at the ileocolic junction.

Operation.—I made a 5-inch incision through the right rectus muscle. After division of the muscle a nodular mass was felt adherent to the parietal peritoneum. The incision was extended at its lower margin in order to enter the free peritoneal cavity.

Whenever you find adhesions between intra-abdominal organs and parietal peritoneum, extend your incision either upward or downward before you try to liberate these adhesions. After you have thus entered the free peritoneal cavity you can proceed safely to deal with the adhesions. The only exception to this rule is in the case of large intra-abdominal abscesses, where a drainage of the abscess without opening of the free peritoneal cavity is the logical procedure.

The finger, inserted into the free peritoneal cavity, revealed that the tumor consisted of omentum. The tumor was dissected from the abdominal wall. The adhesions between the tumor and the abdominal wall were so dense that part of the parietal peritoneum was dissected away with the tumor. It is much safer in freeing adherent tumors to sacrifice a strip of peritoneum, so as to avoid the possibility of entering the tumor.

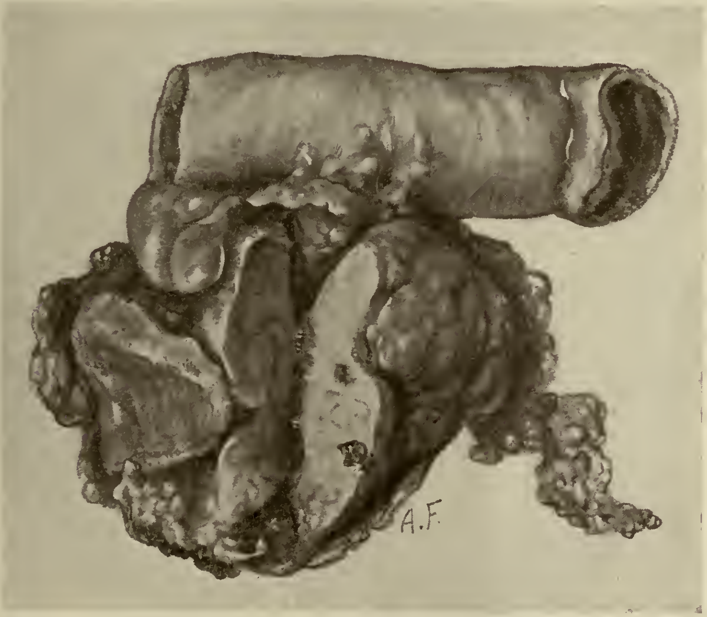

Fig. 236.—Case I. Inflammatory tumor of the omentum with attached segment of transverse colon.

The tumor was densely adherent to the transverse colon. Palpation of the intestinal lumen did not reveal any malignancy of the gut. However, the possibility of a small new growth with perforation into the omentum had to be considered. Furthermore, the mass was so densely adherent to the wall of the intestine that it appeared to be impossible to resect the tumor without entering the intestinal lumen. For these reasons a primary resection of the affected parts (transverse colon and omentum) was decided upon.

After ligation of the vessels 3 inches of transverse colon, with the omental tumor attached, were resected *en bloc*. Both ends were closed with three-layer sutures. The intestinal lumen was re-established by a side-to-side anastomosis. Drainage of the abdominal cavity was effected with two pieces of rubber-dam placed at the site of the anastomosis.

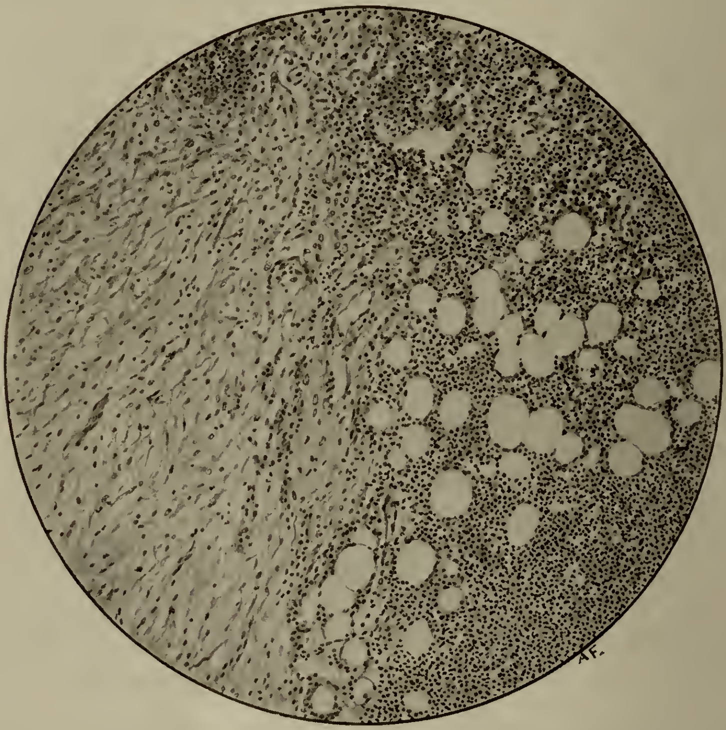

Fig. 237.—Case I. Microscopic section showing acute inflammatory changes in the omentum.

Never use packings at the site of intestinal sutures; they are apt to cause leakage. The packings become attached to the suture line. When you remove the packings, you are apt to establish a fecal fistula.

The abdominal wall was closed in two layers, a layer of strong chromic gut for peritoneum, muscle and fascia, and some interrupted fine silk sutures for the skin.

Macroscopic Report.—The specimen consists of a resected segment of the transverse colon together with a portion of mesentery and adherent omentum. The gut measures about 10 cm. in length. The mucosa shows a small scar at the center of the resected portion. The omentum is densely adherent at this site. There is no perforation of the intestinal wall. The omentum is markedly infiltrated and is the seat of multiple abscesses, varying in size from 1 to 3 cm. in diameter (Fig. 236).

Microscopic Report.—The omentum shows chronic inflammation with marked fibrous and many circumscribed areas of acute purulent inflammation (Fig. 237).

Postoperative Course.—The patient made an uneventful recovery and was discharged on June 20, 1922.

Re-examination (December 3, 1922).—Patient feels perfectly well. He has gained 33 pounds since the operation.

It is a curious coincidence that we should run across 2 cases of a rare type in rapid succession. We encountered this phenomenon—the so-called duplicity of cases—while the patient whom I just presented to you was still in the hospital recovering from the operation.

CASE II

H. S., aged thirty-seven; admitted June 12, 1922.

Previous History.—Eight years ago the patient had an operation for chronic appendicitis. He made an uneventful recovery and was free from abdominal symptoms for over seven years. Seven months ago he noticed a pain in the epigastrium somewhat above and to the right of the umbilicus. Two months ago he noticed a mass in the upper abdomen which has gradually grown larger. No vomiting, no history of hematemesis, or tarry stools.

Status.—Lungs and heart are normal. The upper abdomen is held slightly rigid on palpation. A firm, tender mass is felt in the epigastrium, extending from the middle of the right lower border of the ribs to the left of the ensiform process. It moves slightly with respiration. A 3-inch linear scar is present in the right lower quadrant. Rectal examination is negative.

x-Ray Examination.—The stomach was situated high; its tone and peristalsis were normal. The duodenal bulb could not be visualized. On account of the high position of the stomach the bulb was situated posteriorly to the antrum. The food at once started to pass through the pylorus and the stomach appeared to be emptying rapidly; six hours post cibum it was empty. At this time some of the barium was in the terminal ileum and the rest in the cecum and ascending colon. The cecum was somewhat fixed and tender. Twenty-four hours post cibum the colon was irregularly outlined from the cecum to the rectum.

If I had not benefited from the experience of my first case, I might have erred in making a correct diagnosis. For instance, I might have diagnosed a mesenteric glandular tumor. However, benefiting by the observation of the first case, I made the diagnosis of inflammatory tumor of the omentum.

Operation.—Upper right rectus incision, 3 inches long. As in the previous case, the intra-abdominal mass, whose exact nature I did not know, was adherent to the exposed area of the parietal peritoneum. Therefore I extended the incision below, thus enabling me to enter the free peritoneal cavity without disturbing the relationship of the intra-abdominal mass to the parietal peritoneum. The mass consisted of acutely inflamed omentum. I was now able to safely free the adhesions to the abdominal wall without the risk of entering a viscus. The omentum was dissected free from its attachment to the transverse colon by double ligation. It was so closely attached to the transverse colon that the peritoneum was stripped off over a small area. This defect was closed with three interrupted chromic sutures. I was able by careful dissection to avoid entering the lumen of the intestine. The abdominal wall was closed without drainage. Through-and-through chromic gut was used for peritoneum, muscle, and fascia, and silk for the skin.

Macroscopic Report.—The specimen consists of a mass of inflamed omentum, measuring about 10 x 8 x 3 cm. The resected omentum shows on sections areas of hemorrhage with necrosis and infiltration of the fat with dense fibrous tissue (Fig. 238). Diagnosis: Chronic inflammation of the omentum.

Microscopic Report.—The omentum is greatly thickened and fibrosed. A few small areas of acute purulent infiltration are present (Fig. 239).

Postoperative Course.—The patient made an uneventful recovery and left the hospital on July 2, 1922. He presented himself one month after his discharge in perfect condition.

December, 1922: Patient cannot be located.

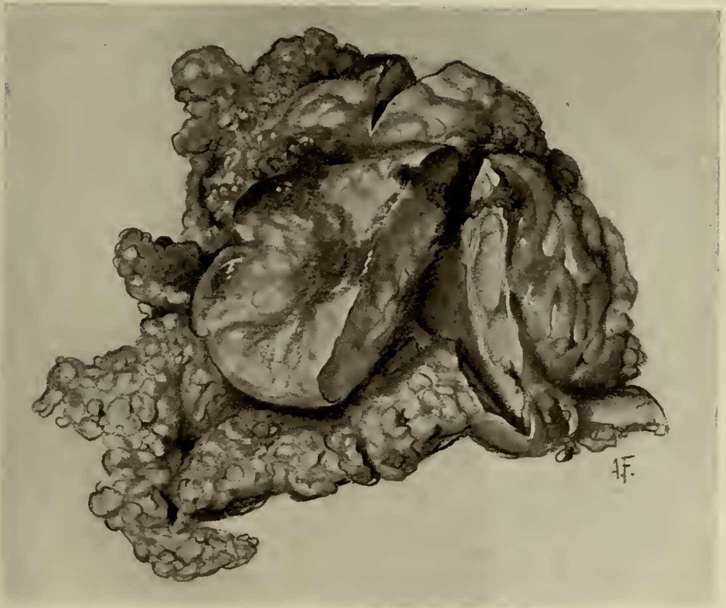

Fig. 238.—Case II. Chronic inflammatory tumor of the omentum.

The etiology of these so-called primary inflammatory tumors of the omentum is rather doubtful. The majority of them are probably caused in the following manner: A small foreign body (fish-bone, chicken-bone, tooth-pick, etc.) is accidentally swallowed by the patient. On its way through the intestine such foreign body may be temporarily caught in the mucous membrane of the gut before the peristalsis pushes it on. It is passed per rectum, embedded in feces, very often unnoticed by the patient, who may not have been aware that he (or she) had swallowed a foreign body. While temporarily arrested in one of the folds of the mucosa this foreign body may have caused a small necrotic area of the mucous membrane. This area of necrosis, therefore, represents the portal of entry for the infection. Cocci and bacilli, which are so numerous in the intestinal flora, can then easily wander into the omentum, where they cause acute inflammation with abscesses (see Case I) or the more chronic type (see Case II).

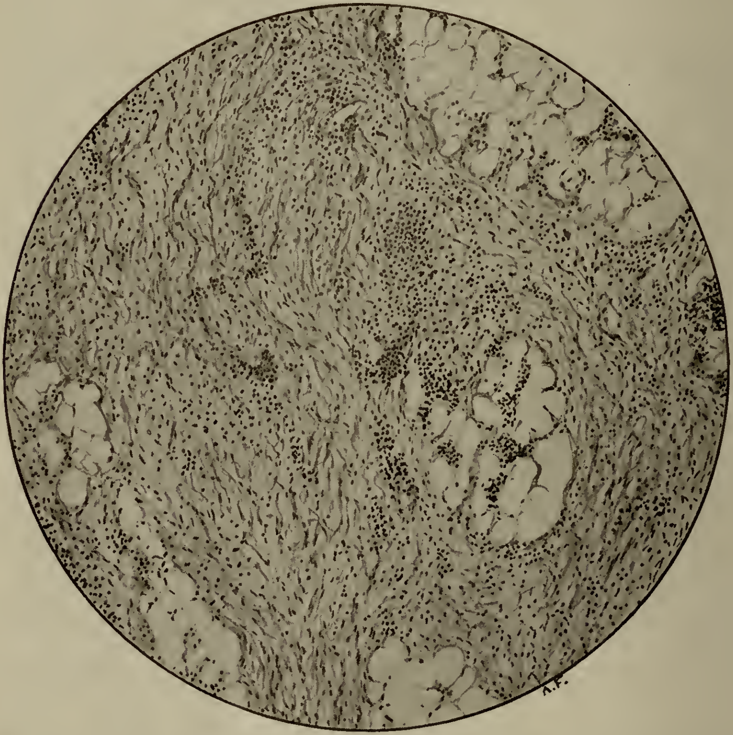

Fig. 239.—Microscopic section showing chronic inflammation of the omentum (Case II).

You will remember that in the macroscopic report of the segment of resected transverse colon (Case I) the only abnormality mentioned was a small scar. Such a scar probably represents the healed end-result of a previous trauma. This scar was very fine and minute, and was detected only after careful search. It is very probable that in Case II we could have demonstrated an identical fine scar if we had resected that part of the transverse colon which was densely adherent to the omentum. As it happened we were able to dissect away that portion of the omentum from the intestine without entering the lumen—certainly a much safer procedure than resection of the intestine.

A correct diagnosis is rarely made before operation. As these tumors are hard and nodular, they are usually diagnosed as intestinal neoplasms or mesenteric tumors of cystic or glandular nature. In women they may be erroneously diagnosed as ovarian tumors.

These tumors, though purely inflammatory in nature, may represent microscopically a picture very similar to the round-cell sarcoma. Great care should be taken to avoid an error in diagnosis. The importance of a carefully guided decision is very obvious. Whereas an intra-abdominal malignancy always gives a doubtful prognosis, the inflammatory tumors of the omentum can be permanently cured by simple resection.

If a doubt exists at the time of the operation as to the nature of the tumor, such a tumor should be resected. Primary malignancy (sarcoma) of the omentum is even rarer than the inflammatory tumors. Even though the mass may appear malignant, the patient ought to get the benefit of the doubt, and the possibility of being permanently cured by a comparatively simple operation.

CONTRIBUTION BY DR. NATHAN W. GREEN

NEW YORK

SUDDEN HEMORRHAGE AN OCCASIONAL CAUSE OF DEATH IN EPITHELIOMA OF THE ESOPHAGUS

DURING the past two years I have had 3 cases of sudden and fatal hemorrhage in carcinoma of the esophagus. Two were after radium treatment. One died without the therapeutic use of the *x*-ray or of radium. All 3 died with very little warning. All 3 were up and about. Two had premonitory cough; these were the 2 after radium treatment. Each of these died with an overwhelming hemorrhage only a short time after cough was noticed. The third, who had not had radium, first noticed a little staining on his handkerchief. Ten minutes after this he had a violent hemorrhage, and seven hours later another, and later a third, from which he died.

In only one of these cases were we fortunate enough to obtain an autopsy. The rarity of this cause of death and the still greater rarity of an autopsy in this complication makes this case of peculiar interest and leads me to report it somewhat in detail. This one (J. B.) gave a long and indefinite history of imperfect esophageal functioning, with the picture of delay at the cardia. On one esophagoscopy the epicardia remained closed during respiration, as if by some spasm. An ulcer was also detected on the posterior wall of the esophagus opposite the tracheal bifurcation. This ulcer was a flat epithelioma about 4 cm. in length by 2½ cm. in breadth. At autopsy a small gland was found near the bifurcation of the trachea, but no metastases and no marked involvement of glands were present. The epitheliomatous ulcer was flat and apparently did not extend below the muscular coat of the esophagus. In the middle of this cancerous area was an eroded intercostal artery. On splitting open the aorta this proved to be the first right intercostal (probably the right side). From this the fatal hemorrhage had come.

These 3 cases are so nearly alike in the picture they present and in their mode of exit so nearly identical that it seems safe to assume the other 2 died also of an erosion of an intercostal vessel close to the aorta. The location of the malignancy in all 3 was similar, that is, near the tracheal bifurcation.

This contribution is submitted to call attention to the fact that massive fatal hemorrhage may occur in the course of carcinoma of the esophagus. It is of particular interest in that it is here shown from what vessel the fatal hemorrhage may come.

I have not seen a profuse hemorrhage from the esophagus where the growth was situated near the cardia.

The following is a brief history of each of the 3 cases:

Case I.—V. B., a man fifty-nine years of age, was referred to me on January 17, 1921, with a history of dysphagia for solids for the past nine months. Also at that time blood appeared on the stomach-tube when it was withdrawn.

The roentgenograms taken by Dr. William H. Stewart showed an obstruction of the esophagus.

When he lay down or when food went down he gave a history of froth coming up.

On January 24, 1921 he was admitted as a private patient to St. Luke's Hospital, with the additional history of loss of weight and spitting up some bright red blood.

On January 25th an esophagoscopy was done by me, and the diagnosis of carcinoma of the esophagus near the middle, about 13 inches from the incisor border, established.

On January 28th a gastrostomy of the Janeway type was done under gas and oxygen, and he was discharged on Feburary 14th improved.

I referred him then to the Memorial Hospital, where I gave him radium treatment twice as follows:

On February 16, 1921 he had 3 tubes filtered with 1 mm.

platinum of 189 m.c. for four hours, making 756 m.c. hours to the esophageal site. No upset followed this treatment, and he was discharged on February 19th improved.

On July 20, 1921 he had 4 tubes with ½ mm. platinum filter of 123 m.c. for five hours, making 615 m.c. hours to the esophageal site. He was discharged July 28th. He was now fairly comfortable and swallowing soft solids, besides using his gastrostomy tube.

However, on August 11, 1921, after excessive cough for a few days, he had a violent hemorrhage, and died suddenly.

Case II.—G. T., a man fifty years of age, was referred to me in May, 1921, with a history of "throat trouble" and dysphagia for solids.

On May 28, 1921 he was admitted to Division A, St. Luke's Hospital, and roentgenograms taken by Dr. LeWald located a growth about the midportion of the esophagus. This later was confirmed by esophagoscopy, and was reported carcinoma of the esophagus of the squamous-cell type.

On May 31, 1921 a Janeway gastrostomy was done, and while in the hospital his thumb was removed on June 14th for an epithelioma which apparently followed an infection. This also was reported by the pathologist, Dr. Knox, as a metastatic squamous-cell epithelioma.

He was then referred to the Memorial Hospital, and on July 7, 1921, 248 m.c. of radium emanation was left *in situ* for four hours. His swallowing improved following this treatment, and on July 12th he was discharged.

On July 30, 1921 I made a visit to his house, where he appeared to be improved. At about noon of that day he had a sudden overwhelming hemorrhage and died.

Case III.—J. B., a man fifty-eight years of age, was referred to me by Dr. LeWald with the roentgenologic report that there was delay in the region of the aortic arch indicating the presence of new growth, but this required confirmatory examination and an esophagoscopy was advised.

On December 6, 1921 he was admitted to Surgical Division A, St. Luke's Hospital for diagnosis. His chief complaint was dysphagia for six weeks and pain in midchest on swallowing.

On December 8th the esophagoscope was passed, with the following picture: "The cardia of the stomach opened and closed normally, the orifice was normal in size, and the esophagus throughout seemed normal except for an area about 10½ inches from the teeth, which seemed to bleed somewhat more readily than other portions." The area which bled readily was touched with 10 per cent silver nitrate and a No. 36 bougie was readily passed into the stomach.

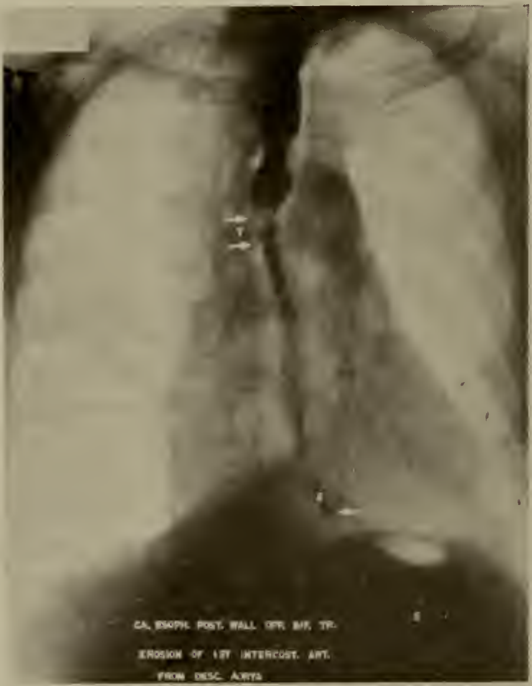
T
E
CA. ESOPH. POST. WALL OPP. BIF. TR.
EROSION OF 1ST INTERCOST. ART.
FROM DESC. AORTA

Fig. 240.—Case III. Epithelioma of the esophagus opposite the crossing of the left bronchus near tracheal bifurcation. The location of ulcerated growth is shown at T. Delay in the passing of the bismuth is also shown at E. This case died from ulceration of first right intercostal artery near descending aorta. An autopsy was obtained. (Roentgenogram by Dr. L. T. LeWald.)

On December 10th the patient left the hospital without incident.

On January 4, 1922 he came to my office, where a No. 36 and No. 38 French bougie was passed with ease and without trace of blood.

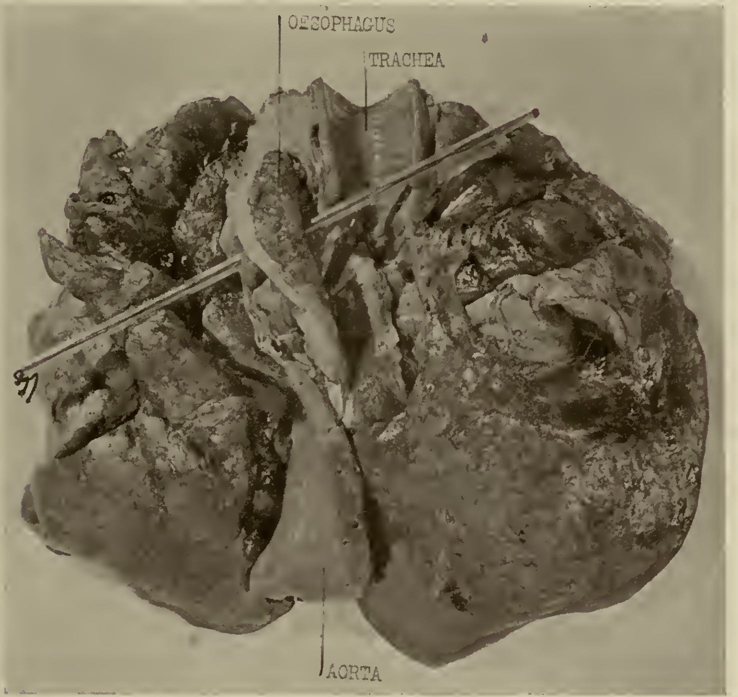

Fig. 241.—Case III. Autopsy findings. The descending aorta is split open and a glass rod passes through the first right intercostal artery as it springs from the aorta and emerges through the center of the ulcerated growth as shown in Fig. 242. (Photograph taken by M. W. Keller.)

Again on January 18th a No. 36 bougie passed easily with no blood. He was given bismuth subcarbonate and soda bicarbonate powders.

On February 7th he weighed 151 pounds. He said at this time that he was *"so sore"* across his chest that he did not want a bougie passed.

On February 28th he said that he could swallow meat, but when he did so he "felt it" under the middle of his sternum.

On March 14th he weighed 154 pounds, but he still complained of soreness in his esophagus and across his chest in front when swallowing. A bougie hurt him and was passed only with the utmost delicacy for 9 inches.

On April 21st he still complained of pain across the front of his chest at the level of the third costal cartilage. He was referred back to Dr. LeWald for further roentgenograms.

On April 28th he reported that the roentgenologic examination showed some delay at the lower end of the esophagus, as being still present, which probably required further observation with the esophagoscope. The stomach showed slight delay in its emptying time. The fluoroscopic examination showed slight delay in the region of the aortic arch, also at the cardiac end of the esophagus. The stomach was dilated, the greater curvature was about 3 inches below the umbilicus. No filling defect was observed in the stomach or the duodenum. The stomach was emptying at a fair rate. There was a small retention for four hours and fifty-five minutes. (A dilated stomach is unusual in cases of esophageal obstruction.)

On May 12th he still complained of soreness across his chest. A No. 32 bougie was passed for 10 inches with great gentleness; after this point it was so sore that he would not let it pass further. There was no blood with any of these attempts.

He went away to the country for a month, and was advised to come into the hospital when he returned for observation.

On June 23d he said that he felt fine, but was "awful sore" across his chest.

On July 11th he still complained of soreness, especially in his right chest, and could only lie in one position.

On October 2d he complained of tenderness in the epigastrium and pain under the right shoulder, and still had a soreness in the right chest. It hurt him to swallow. He had been gaining weight steadily until recently, when he began to lose again.

He re-entered the hospital on November 8th for further examination and was *x*-rayed again on November 10th. The roentgenograms showed "delay in the esophagus" with "some irregularity in the region of the aortic arch."

On November 14th he was esophagoscoped, and at this sitting the cardia remained closed during respiration, and an ulcerated area was found, which bled, on the posterior wall of the esophagus at the level of the tracheal crossing.

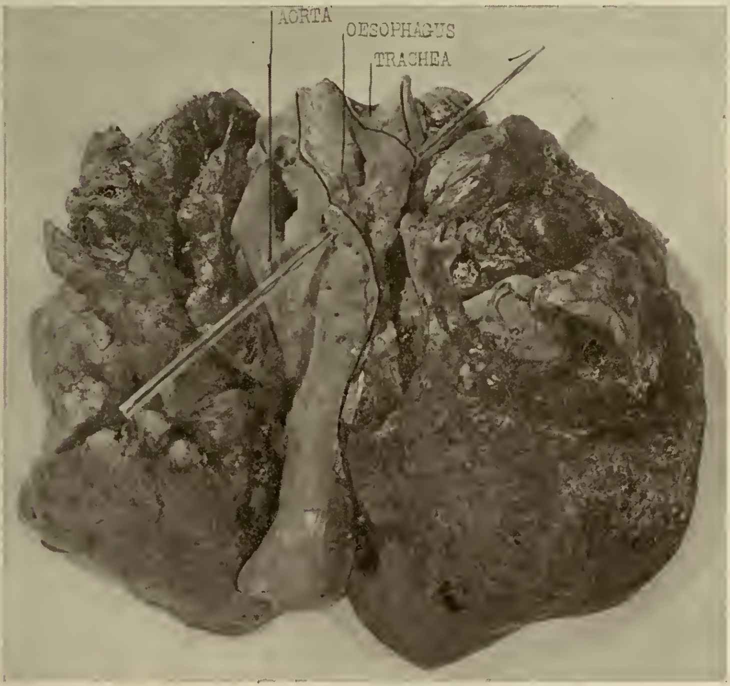

Fig. 242.—Case III. Autopsy findings. The glass rod is shown coming out through the center of the epithelioma. Note the small size of the growth and the comparative absence of adhesions to and infiltration into surrounding structures. (Photograph taken by M. W. Keller.)

The soreness still persisted.

On the morning of November 20, 1922 he had a slight cough and blood tinged his handkerchief. At 11 A. M. he had a massive hemorrhage, which rendered him unconscious for awhile. At 6 P. M. he had another and lost consciousness, and after a third he died early on the morning of the 21st.

At the autopsy the first intercostal from the descending aorta was found eroded at the middle of the cancerous ulcer of the esophagus. His stomach contained 1 liter of blood. A straw passed directly through the first right intercostal came out at the middle of the area of the esophageal ulcer. There were no metastases and there was one small gland near the bifurcation of the trachea. The epithelioma had not penetrated deeper than the muscular coat of the esophagus. The pathologic report by Dr. Knox was epithelioma of the squamous-cell type.

CLINIC OF DR. DE WITT STETTEN

Lenox Hill Hospital

ANOMALOUS RELATIONS OF THE CYSTIC DUCT OR GALL-BLADDER TO THE HEPATIC DUCT

I would like to present to you 2 cases of anomalous relations of the cystic duct or gall-bladder to the hepatic duct, in one of which the hepatic duct was unwittingly injured, and in the other injury was avoided because the anomaly was recognized in time. You may know that, according to Calot,[1] the cystic artery normally forms with the junction of the cystic and hepatic ducts a triangle, which has been termed the "triangle of Calot" (Fig. 243). This arrangement, however, is by no means con-

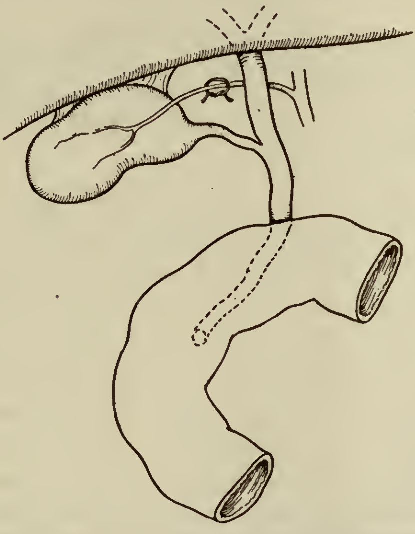

Fig. 243.—Usual relation of cystic artery to junction of cystic and hepatic ducts, forming so-called "triangle of Calot." Typical ligature of cystic artery.

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[1] Calot: De la Cholécystectomie, Thèse de Paris, 1890, No. 52, p. 50.

stant. The cystic duct may run parallel to the hepatic duct or may even make a spiral turn behind it. Ruge[1] has estimated the cases of parallelism as high as 33 per cent. In other cases the cystic duct itself may be practically non-existent and the gall-bladder may lie in a parallel relation to the hepatic duct. Injury to the hepatic or common duct, due to a failure to recognize these abnormal relations, is not an unusual accident, and has been reported on by W. J. Mayo,[2] Koerte,[3] Kehr,[4], [5] Eliot,[6] Eisendrath,[7] and others. My purpose in presenting these 2 cases to you is to demonstrate how easily duct injury can occur under these conditions, and how it may be avoided if the surgeon is aware of the possible existence of these anomalies.

CASE I. CALCULUS IN GALL-BLADDER; PARALLELISM OF CYSTIC AND HEPATIC DUCTS; CHOLECYSTECTOMY; ACCIDENTAL LIGATION AND DIVISION OF HEPATIC DUCT; RECOGNITION OF INJURY AND END-TO-END SUTURE OF DIVIDED HEPATIC DUCT

This lady is now seventy-three years of age. In April, 1914 she came to me with the following history: She was then sixty-four years of age and had had 6 children, the youngest being twenty years old. She had never had typhoid fever. She had been ill for about ten years, suffering from indigestion accompanied by attacks of pain in the right hypochondrium, vomiting, and occasional jaundice. She had lost considerable weight, but had never passed any calculi in the stools. On examination there was a definite sensitiveness in the right hypochondriac region. Her weight was 93 pounds.

The characteristic history warranted the diagnosis of gall-bladder disease, probably cholelithiasis.

On April 27, 1914 I exposed the gall-bladder through a right hypochondriac incision. A small, somewhat thickened gall-bladder was found, adherent at its fundus to the duodenum. It contained one small ovoid stone. No calculi were palpated in the ducts. I separated the gall-bladder from the duodenum, and found, when the gall-bladder was freed, a small fistulous opening into the duodenum. This was closed with a single purse-string suture of silk. I then proceeded with the cholecystectomy in the usual fashion, from above downward. This was by no means exceptionally difficult. After separating the gall-bladder from its bed in the liver, I very carefully passed the usual ligature around what I took to be its mesentery, and divided with my scissors the tissues distal to the ligature. I was very much dismayed to find a gaping lumen of about 0.5 cm. diameter in these tissues. I at once suspected what I had done, and, removing the ligature, caught the cystic vessels separately and ligated them. I then placed a gauze tampon against the proximal lumen of what was undoubtedly the completely divided hepatic duct, from which the bile literally poured. The anatomic

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[1] Ruge: Archiv. f. klin. Chir., 1908, vol. lxxxvii, p. 47.

[2] Mayo: Annals of Surg., 1905, vol. xlii, p. 90.

[3] Koerte: Archiv. f. klin. Chir., 1909, vol. lxxxix, p. 1.

[4] Kehr: Chir. der Gallenwege, Neue Deutsche Chir., 1913, vol. viii, p. 464.

[5] Kehr: Die Praxis der Gallenwege-Chirurgie, 1913, vol. ii, p. 183.

[6] Eliot: Surg., Gyn., and Obstet., 1918, vol. xxvi, p. 81.

[7] Eisendrath: Surg., Gyn., and Obstet., 1920, vol. xxxi, p. 1.

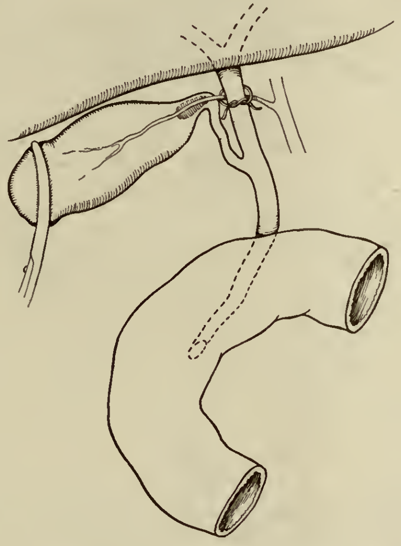

Fig. 244.—Case I. Parallelism of cystic and hepatic ducts, with ligature of cystic artery accidentally including hepatic duct.

conditions responsible for this accident are well illustrated in the drawings (Figs. 244, 245), which show a parallelism of the cystic and hepatic ducts instead of the usual angular junction, and illustrate how careful one should be in passing the ligature around the cystic artery. The cystic duct was next quickly freed and ligated, and the gall-bladder removed. The two cut ends of the hepatic duct were then exposed, and it was seen that the point of division was just below the junction of the right and left ducts; in fact, the two openings could easily be seen and probed.

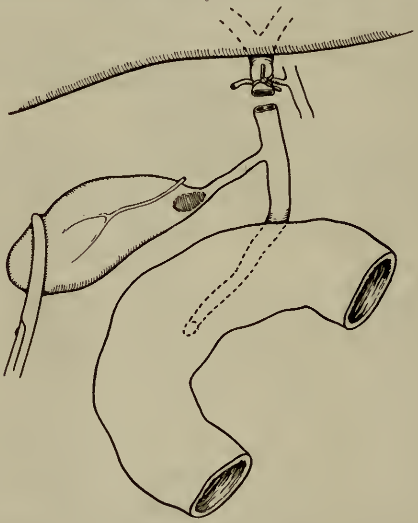

Fig. 245.—Case I. Ligature around cystic artery and hepatic duct tied, with cystic artery divided and complete transverse division of hepatic duct.

Fortunately, the duct was rather wide and its tissues were healthy, so that it was not very difficult to approximate the two ends with interrupted sutures of fine catgut, which were passed through the entire thickness of the duct. I began posteriorly, as indicated in the illustration (Fig. 246), and made a complete circular suture. Anteriorly I reinforced the suture line with a second row and covered the suture with omentum. A cigarette drain was placed lateral to the line of suture and a gauze tampon laid in the liver bed. The abdominal wound was closed in three layers in the usual fashion.

The patient's convalescence was relatively uneventful. For about a week there was a rather profuse drainage of bile, although from the very beginning the stools were distinctly colored. The abdominal wound healed well and the biliary drainage gradually decreased, until, on the day of the patient's discharge from the hospital, twenty-six days after the operation, it had practically ceased. Since that time she has been perfectly well. There have been no attacks of pain, fever, or jaundice which would suggest a stenosis of the duct, and her gastric symptoms have entirely disappeared. As you see, for a woman of her years, she appears to be in excellent physical condition. She now weighs 132 pounds, having gained 39 pounds since her operation. A small ventral hernia is present in the scar at the point of drainage.

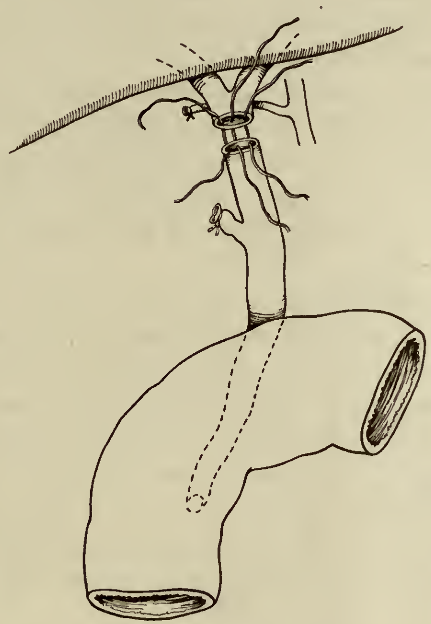

Fig. 246.—Ligature around hepatic duct removed, cystic artery separately ligated, cystic duct ligated, and gall-bladder removed. End-to-end suture of divided hepatic duct begun posteriorly.

CASE II. DIRECT JUNCTION OF GALL-BLADDER WITH COMMON DUCT; LARGE CALCULUS PROTRUDING FROM REMNANT OF CYSTIC DUCT INTO COMMON DUCT; PARALLELISM OF GALL-BLADDER TO HEPATIC DUCT; CHOLECYSTECTOMY WITH COMMON DUCT SUTURE

This lady is forty-eight years old. She has had 3 children, the youngest being twenty years of age. She has never had typhoid fever. For twelve years she suffered from indigestion with pain, particularly after eating improper food. For the past few years these attacks were rather more severe in character and were accompanied by nausea and vomiting. The pain was usually located in the epigastrium and radiated to the back and shoulders. Her last attack began in the latter part of December, 1922. On January 15, 1923 she had particularly severe pain, and two days later she had a slight chill and some fever. She also vomited occasionally. During this attack she lost about 25 pounds in weight.

I saw the patient first on January 20, 1923. She was distinctly jaundiced, although not intensely so, and she was markedly sensitive in the right hypochondrium, but there was no mass to be felt and no abdominal rigidity. Her temperature was 101° F. Her clinical history, which in these cases is really the most important deciding factor, pointed definitely to a chronic gall-bladder condition which had become acute. There were signs of common duct obstruction, probably due to a calculus, and of an infectious process, most likely in the gall-bladder.

On January 22, 1923 I exposed the gall-bladder through the usual right hypochondriac incision. It was found to be rather small, much thickened, and friable; its serosa was injected and there were dense adhesions of the omentum to the fundus. Numerous small calculi were palpated in the gall-bladder, and one large ovoid stone, the size of an olive, was found at what appeared to be the junction of the common and cystic ducts. After separation of the adhesions from the fundus of the gall-bladder a cholecystectomy was begun from above downward. The cystic vessels were ligated close to the gall-bladder, and it was then seen that the hepatic duct and gall-bladder ran parallel and were quite adherent to each other (Fig. 247). The cystic duct was considerably dilated and thickened. Some difficulty was experienced in separating these structures, but this was finally accomplished without injury to the hepatic duct. During this procedure, owing to its friability, the gall-bladder was opened and a large quantity of mucoid pus containing several small faceted stones was evacuated and swabbed out. The gall-bladder was directly attached to the common duct, there being no intervening cystic duct (Fig. 248), and the large ovoid stone was impacted in its neck and protruded for quite a distance into the common duct.

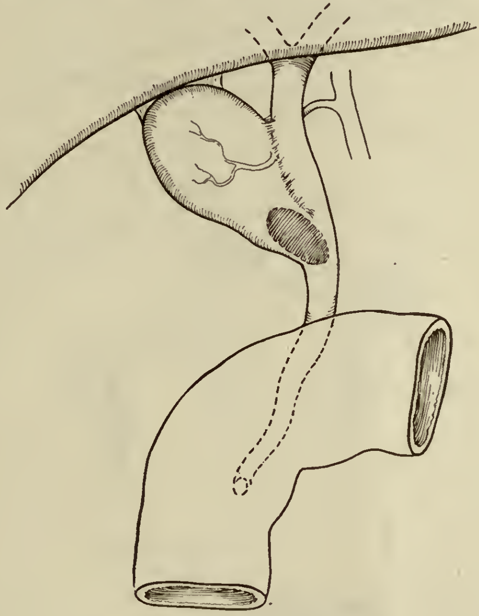

Fig. 247.—Case II. Parallelism of gall-bladder to hepatic duct. Large calculus in neck of gall-bladder protruding into common duct, with practical absence of cystic duct. Common and hepatic ducts dilated.

The gall-bladder with the stone was removed by incising around the neck, leaving a transverse opening in the common duct, which was somewhat dilated (Fig. 249). A sound was introduced upward into the hepatic duct and downward into the common duct, passing easily through the papilla and into the duodenum. No obstruction was noted, although there was no biliary flow. This absence of bile did not surprise me, as it is not an uncommon phenomenon in cases of common duct obstruction. It is due to an arrest of hepatic function, and in mild, not protracted cases, is only temporary. Soon after the obstruction is relieved the bile secretion usually commences again. As there was no evidence of cholangitis in this case, it was decided that hepatic drainage was not necessary, and the transverse incision in the common duct was sutured with continuous catgut.

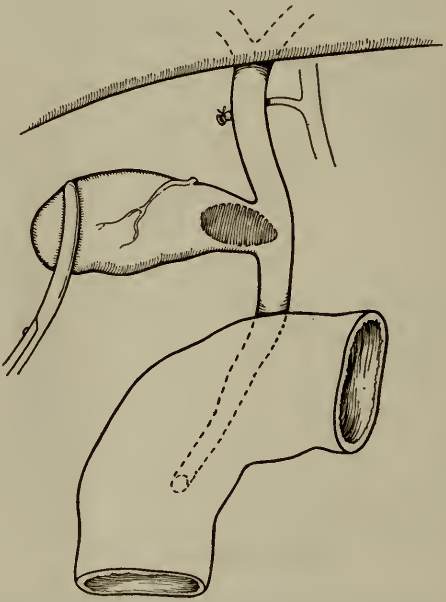

Fig. 248.—Case II. Cystic artery ligated and divided and gall-bladder separated from dilated hepatic duct.

The patient made an uneventful recovery from the operation and for one week drained considerable bile. This biliary drainage ceased on February 1st. The jaundice rapidly cleared up and even the first stools after the operation were colored. The patient is entirely well and seems to be putting on weight. The sutured portion of the wound, you will note, has healed by primary union. There is now merely a superficial granulating drainage sinus, and the patient is almost ready to be discharged from the hospital.[1]

This case is of peculiar interest in comparison with the previous one, as it shows how injury to the hepatic duct can be avoided if the unusual relation of this duct to the gall-bladder or cystic duct is recognized during the operation. It also shows that drainage of the hepatic duct is not always necessary in common duct obstruction, and that the closure of the common duct after the removal of the obstruction may be performed with safety and a considerable hastening in the postoperative recov-

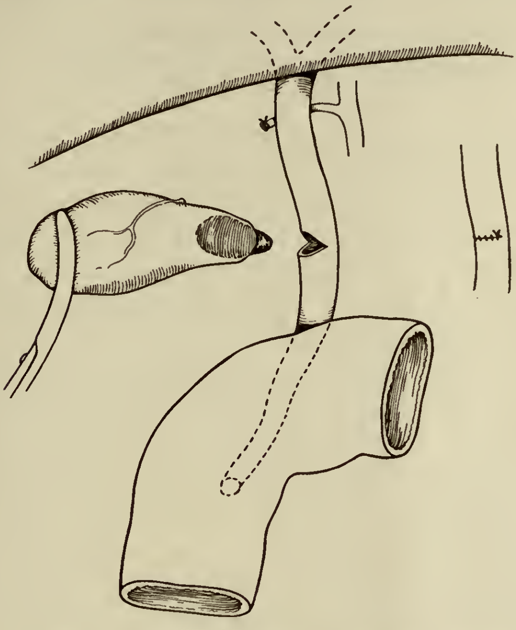

Fig. 249.—Case II. Removal of gall-bladder and calculus from sessile attachment to common duct, with opening in common duct at point of resection. Insert shows suture of opening in common duct.

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[1] This patient was discharged from the hospital, cured, on February 16, 1923, twenty-five days after operation. The wound was practically healed. She was seen by me a month later. She was perfectly well and had gained 10 pounds in weight since her operation.

ery. This tendency, I believe, is gradually increasing, and while I do not advocate it where there is a straightforward cholangitis, I see no reason why it should not be practised in cases where there is no infection in the common, hepatic, or smaller bile-ducts.

These 2 cases also illustrate the advantage of cholecystectomy from above downward. It is readily conceivable that the accident experienced in the first case probably could not have been avoided in the second if the cholecystectomy had been begun with ligature of the cystic vessels and cystic duct.

CLINIC OF DR. A. R. STEVENS

New York Polyclinic School and Hospital

PROSTATIC OBSTRUCTION

It seems to be a common belief among practitioners that the familiar clinical picture of prostatic obstruction is always due to a gross "hypertrophy" of the prostate, and that the only effective treatment is prostatectomy. Yet there are other types of obstruction, which, unfortunately, are usually described as though they were conditions different from and unrelated to the common one (adenoma). However, it must be remembered not only that there are many types of prostatic obstruction, varying in form and pathology, but also that each of these may cause the same typical group of symptoms—frequency of urination by night as well as by day, difficulty, hesitation, and alteration of stream. And I want at the same time to emphasize the fact that there are minor as well as major procedures which afford entire relief in properly selected cases, and that these minor procedures are at times valuable accessories to the major operations.

We should aim first to diagnose prostatic obstruction in general, then to determine its form and pathology before deciding on the suitable remedy. We should regard all prostatic obstruction as mechanical obstruction *per se* which may be physically removed by various methods, the individual variation in type demanding corresponding intelligent variation in operative technic; and the pathology will obviously influence the mode of attack. The urologist should acquaint himself with both of the classical types of prostatectomy (suprapubic and perineal), and also with the special methods which are efficient in dealing with certain cases of obstruction. Surely the time is quite passed for the surgeon to be satisfied with one method of operating for all prostatic obstructions. The patient's temperament, the presence of complications, local or general, the failure to secure satisfactory or complete data in a given case, the patient's social condition—these and other factors will influence us in deciding upon the course to be pursued.

In practice, our first consideration is diagnosis. Are we really dealing with prostatic obstruction, and, if so, what is the form and nature of it?

Little trouble should be experienced in ruling out urinary frequency with large amounts of urine passed at each voiding, due to "medical" diseases, because of the large volume of urine secreted. Also we must eliminate the cases of frequency with small amounts due to increased irritability, the result of inflammation of the genito-urinary tract, of calculus, or of tumor at the vesical neck. The absence of residual urine in the latter group is perhaps the most important differential sign.

Without discussing the question of how often prostatic growth will cause symptoms before residual urine is found, the fact remains that residual urine is the commonest finding in all types of prostatic obstruction with symptoms. Our chief errors in diagnosis concern other causes of residual urine, notably spinal cord disease and diverticulum of the bladder. The fault is often due to sheer neglect, for the diagnosis is usually rendered clear if one will carefully apply the methods of differentiation—neurologic examination, lumbar puncture, cystoscopy, and cystography.

Obstruction may be due to more or less general prostatic enlargement. The common types are adenoma, carcinoma, and acute infection (including abscess). The first requires nothing short of prostatectomy (really lobectomy) for complete relief, and care should be exercised to remove as far as possible all adenomatous tissue to prevent recurrence of the original trouble. Where prostatectomy is not feasible because of organic disease or senility, partial relief may be afforded by less radical procedures.

The treatment of malignant disease is far from a settled problem, but remember that the effect on the act of urination is mechanical, and removal of the obstructing portion of the prostate is necessary if normal urination is to be restored; else passage of urine through the natural channel must be given up for a permanent suprapubic opening. In these cases the pathology has great weight in influencing our decision concerning the therapy. Besides mechanical relief, the possible cure of malignancy is to be considered. Radium has its exponents, although some workers of considerable experience lack enthusiasm. But bear in mind that even with the advocates of radium, the relief of obstruction is often a separate problem requiring the physical removal of an adequate amount of obstructing tissue at the vesical neck by mechanical means or by actual gross tissue destruction with radium through a suprapubic cystotomy wound. The future of deep therapy with the Roentgen ray seems to offer more hope, but its use in malignancy of the prostate is a scarcely explored field. The possibility of a cure by radical complete surgical removal of the whole prostate gland and certain neighboring structures in selected cases of early malignancy cannot be discussed at this time; the frequency of incontinence following this operation is a deterrent.

The third type of gross enlargement commonly encountered is that due to acute inflammation. This may need medical and hygienic measures only, to assist resolution and consequent relief of the obstruction; but if an abscess be present, surgical drainage is added.

In the group of obstructions due not to gross prostatic enlargement, but to a relatively small bit of tissue at the vesical neck (so situated as to cause the maximum harm), accurate cystoscopic diagnosis may save the patient a major operation and often leads to extraordinary results from minor procedures. A very small pedunculated middle lobe without general enlargement, a "median bar" of prostatic tissue, a "contracture of the vesical neck" due to connective tissue, or a cyst may produce symptoms and deleterious effects equal to those encountered in a case of general hypertrophy. These cases are diagnosed by painstaking study with various models of cystoscopes and urethroscopes. The vesical neck can be studied on the bladder side by right-angle vision, and on the urethral side by both right-angle and direct vision. Correct interpretation of these views is often difficult, but will frequently give one a clear mental picture of the existing conditions. Perhaps nowhere may one find a better illustration of the fundamental teaching in medicine that accurate diagnosis is the necessary basis of efficient therapy. For, in this group of obstructions, it is amazing what tremendous relief is afforded by the removal of a very small bit of tissue.

If the tissue to be excised will fit into the depression of the Young punch or some modification of the same, this instrument provides a simple and adequate means of cure. Geraghty has shown that even simple cutting through of the obstruction in certain cases gives relief, and has devised a cutting blade to fit the sheath of the Young instrument. Cauterization by the high-frequency current has proved satisfactory in selected cases. Some surgeons, knowing the difficulty of correctly interpreting the cystoscopic and urethroscopic views of the vesical neck, prefer to explore all such cases suprapubically; then to remove the obstructive tissue by scissors or knife or by some type of rongeur forceps, or by the Young punch (which I have found very helpful after cystotomy, and which can be accurately applied with suprapubic guidance, and reapplied and used as often as may be necessary until the obstruction is removed).

The need for and the methods of determining a patient's fitness and the means for improving the same are equally applicable to all types of prostatic obstruction. As these have been discussed by so many writers in recent years, we will take for granted a knowledge of the value of clinical findings, renal function tests, and blood chemistry. A word of caution is needed. Far from decrying the value of laboratory tests, I utilize them freely and persistently. But one hears so great emphasis laid on this or that finding, it seems necessary to continually call attention to the greater value of clinical observations. Good surgeons who were competent observers obtained excellent results from prostatectomy before the present era of practical blood chemistry.

The following brief case reports illustrate some of the types of obstructions referred to and the treatment regarded as appropriate:

Case I.—A man sixty-seven years old had noted some urinary frequency about four years. The frequency had increased rapidly the past few months prior to his first visit to my office; then he got up six to eight times at night. There was difficulty in starting the flow, and discomfort in the prostatic region; no hematuria. Patient has never been catheterized.

Examination.—General condition was excellent. Output of phthalein in two hours 40 per cent. Residual urine 190 and 250 c.c. on two occasions. Prostate felt by rectum was moderately enlarged, symmetric, and typical of adenoma in consistence. Cystoscopy showed marked trabeculation of bladder wall, and moderate enlargement of the prostate in the form of a collarette posteriorly, with a fairly large lobe anteriorly.

Preliminary examinations were all satisfactory, and perineal prostatectomy was performed by the Young technic. Two lateral lobes of moderate size were removed; the anterior lobe came away with the left lateral lobe. A finger introduced into the urethra felt a large vesical neck with soft margins, no median posterior obstruction and no anterior lobe.

All went well the first twelve days after operation and patient was out of bed and walking. Then, without warning, a moderately profuse hemorrhage occurred from the wound. There was no recurrence of bleeding and the subsequent course was uneventful. A record made five weeks after operation noted that the urinary control was good; the interval by day was three to four hours, and at night the patient had from seven to eight hours uninterrupted sleep. The flow was easy, and there was neither difficulty nor urgency. Residual urine 8 c.c.

Case II.—A man fifty-nine years old had had great frequency of urination for about ten years. When he came under my observation he was voiding about twenty times a day and four to five times at night. Urgency and difficulty in starting the flow were inconstant symptoms. He had had intermittent treatment for syphilis in the past eighteen years, the last three years of which had been especially for spinal cord involvement.

Examination.—The reflexes were all active. No Romberg sign present. Residual urine varied from 50 to 100 c.c. The prostate was found to be uniformly much enlarged and protruding markedly into the rectal lumen, with the consistence of adenoma. On cystoscopy and urethroscopy a lobe of prostate was found protruding into the urethra near the vesical neck, but there was very little intrusion of the prostate into the bladder. The bladder wall presented over much of its surface a fine trabeculation noted so often in spinal cord disease.

The case was referred back to the neurologist, but the latter on two occasions assured me that he felt convinced that the spinal cord condition was healed and believed it had not caused the urinary disturbance. He saw no need of a spinal puncture. Operation apparently offered a prospect of some relief and, accordingly, a perineal prostatectomy was done. Two lateral lobes of moderate size were easily enucleated. The palpating finger in the urethra revealed a tight vesical outlet with an elevation posteriorly. A Young punch was introduced and several bites taken, after which the orifice seemed of normal size and non-obstructing. The convalesence was uneventful; urine came from the wound for the last time on the eighteenth day.

The frequency of urination was not improved after operation. During the following six or eight months the patient was seen occasionally. The residual urine varied from 5 to 150 c.c. Cysto-endoscopy showed a flat smooth floor at the vesico-urethral junction. Treatments of the prostatic urethra gave no real improvement. Obviously, the spinal cord disease was the sole cause of the urinary complaints. The spinal fluid from a lumbar puncture done subsequently gave a positive Wassermann test.

Case III.—This patient was fifty-eight years old. He had contracted syphilis fifteen years ago and been thoroughly treated.

The Wassermann has remained negative the past three years. There were no symptoms of spinal cord disease. Some urinary frequency had been noted for seven years, and for a long time the patient had gotten up three to four times at night. During the two weeks prior to my first observation urination had been about every hour. Yet the patient's chief complaint was of a distended abdomen, which he thought due to gas.

Examination.—The man was slim and sallow, but looked superficially in good health. Marked distention of the bladder was apparent to the eye and to the palpating hand. A catheter drew 725 c.c. of clear urine, with specific gravity of 1005. A phenolsulphonephthalein test gave only a pink color, not a measurable quantity of dye. The urea, uric acid, and creatinin percentages in the blood were all near the upper limits of normal. The blood-pressure was systolic 210, diastolic 150. Cystoscopy revealed marked trabeculation of the bladder. The views of the prostatic border were interpreted to mean two lateral lobes and a middle one projecting into the bladder lumen.

The patient was put on intermittent catheterization for nearly two weeks. The residual urine dropped to 440 c.c., but the specific gravity of the urine remained low. After this first two weeks an indwelling urethral catheter was employed and continued for about ten days. The specific gravity gradually rose to 1011, and total output of urine for twenty-four hours dropped from 4000 to 2200 c.c. The nitrogenous constituents of the blood remained about the same. Two phthalein tests were done two days apart, and each gave only a good trace of color. The appetite was improved and sleep was sound and refreshing.

It was felt that we had gained sufficient from the preliminary treatment to warrant operation. Perineal prostatectomy was done under gas and oxygen anesthesia. After removal of the moderate-sized lateral lobes a finger was introduced to the vesical neck. A pedunculated middle lobe which had escaped thus far was felt, and was easily enucleated through the urethra by the palpating finger.

The patient had hiccups off and on for five to six days after operation; otherwise convalescence was uneventful during the stay in hospital—a little over three weeks. The phthalein test done eight weeks after operation gave 25 per cent. in two hours; blood-pressure, systolic 170; residual urine, a few cubic centimeters. The patient voided normally as much as 450 c.c. at a time, with a good stream. A year after operation the patient could sleep six to eight hours without arising to urinate, and voided at intervals of two to four hours in the day; residual urine was 5 to 10 c.c.; phthalein 72 per cent. in two hours.

When prostatic obstruction is due to or is a part of general benign enlargement, a general prostatectomy (lobectomy) is indicated. The perineal operation is technically more difficult than the suprapubic, but the convalesence is more comfortable for the patient, and the mortality of the perineal route in competent hands is certainly a little lower than that of the suprapubic route employed by skilful surgeons. In addition, the suprapubic operation is followed by ventral hernia in a certain number of cases. Hence my attitude is always in favor of the perineal route unless there be present some such specific reasons as those to be mentioned for making a suprapubic opening. Some patients will not tolerate an intra-urethral catheter and suprapubic drainage is necessary in the preliminary preparation for operation. In other instances cystoscopy is not satisfactory and direct visual examination of the vesical neck is desirable. Then, of course, the trouble may be dealt with in the manner best adapted to the particular case. Cystoscopy may reveal a tumor, a diverticulum, or large calculus of the bladder, conditions that obviously should be approached from above. A large middle lobe is also more easily handled suprapubically.

The two chief objections to perineal prostatectomy are the occasional lack of complete control following operation and the occasional injury to the rectal wall. Incompleteness of control of urination is most often due to injury of the external sphincter. I have more and more sought to avoid this muscle, and, accordingly, have made the incision in the urethra further and further away from (posterior to) that muscle, and now frankly cut into the urethra through the apex of the prostate instead of the membranous urethra. Regarding the possibility of rectal injury, in most cases the dissection between urethra and rectum on either side of the midline is easy, but trouble is sometimes encountered in the midline because the rectal wall is held close to the urethra by the recto-urethralis muscle. This muscle can usually be recognized and cut under visual control, but if there be any doubt as to the location of the rectal wall, do not hesitate to locate it by placing a finger in the rectum.

The 3 cases cited thus far were chosen to emphasize the importance of forestalling later trouble by examining the vesical neck with a finger after the perineal prostatectomy is completed. In the first instance, a soft, smooth, regular, large opening was found. In the second, a rigid, tight orifice was palpated. The situation was splendidly handled by the Young punch; several pieces of fibrous tissue were removed, leaving a large, free opening. In the third instance, a small pedunculated lobe was felt and easily removed by the palpating finger. This could easily have vitiated the result and led to the necessity of another operation.

The second case was purposely selected not only for the reason named above, but to warn against operating on the prostate in the presence of a cord lesion. I had suspected this pitfall, but was urged to operate in the hope that prostatic obstruction was the chief cause of the urinary complaint.

Case IV.—A man sixty years old was seen in great distress. He was voiding every few minutes and had a bladder visibly distended to the umbilicus. For six or eight months he had been getting up several times at night. For six weeks the frequency had gotten rapidly worse; and for four days the patient had been straining, with very frequent urination of small amounts, and had suffered much pain from the distended bladder and from hemorrhoids. He was markedly constipated and the general condition very poor.

Examination.—The patient was very thin, weak and pale, and looked much older than his years. His teeth were very bad; many had been recently extracted. Catheterization brought 660 c.c. of very foul urine. The prostate was much enlarged, rounded, with median furrow obliterated, elastic, and protruded markedly into the rectal lumen. Clinically it was an adenoma with no signs of malignancy.

Intermittent catheterization was employed for two days while arrangements were being made. Then under local anesthesia suprapubic cystostomy was done. The blood at this time showed a marked secondary anemia, with hemoglobin 46 per cent.; the total non-protein nitrogen was 185 mg. per 100 c.c. of blood; the blood urea, 222; creatinin, 1.8; uric acid, 4.7. The phthalein output for two hours was 14 per cent. two days after cystostomy, and but 15 per cent. six days after operation. On the day of the last phthalein test the blood urea was 183.

The wound was kept clean and the patient was perfectly comfortable wearing the suprapubic tube, but the condition far from satisfactory, and after ten days in the hospital the patient was sent off to the country with a trained nurse. On his return in two months the phthalein output for two hours had risen to 58 per cent., and the urea in the blood was 41 mg. per 100 c.c. The patient's color was excellent and he had gained 30 pounds.

The usual custom in the so-called two-stage prostatectomy is to enlarge the cystostomy wound and remove the prostate through it. In this case, as the sinus was so clean and the surrounding tissues free from inflammation, I dissected out the tract to the bladder, then enucleated the prostate by the familiar technic, beginning on the roof of the urethra. The two lateral lobes and the moderately large middle one were removed in one piece. There was no excessive bleeding.

The postoperative course was uneventful. The last bit of leakage of urine from the wound was on the twenty-second day after operation. Four weeks after operation the patient was voiding with ease as much as 300 c.c. at a time. Residual urine was 10 c.c.

In Case IV the opening made in the bladder to afford the needed drainage and the lack of an early cystoscopy offered a double argument for a suprapubic prostatectomy, and the incidental exploration of the bladder thus made possible. Perineal prostatectomy has been done after preliminary suprapubic drainage, but I believe this is pushing one's enthusiasm for the perineal approach too far as a routine measure.

The following case report illustrates another reason for a suprapubic approach, a reason which the best cystoscopists readily admit is not infrequent. Even after instrumental examination we did not feel sure that operation through the urethra would be effective, and in this case it was most desirable for temperamental reasons not to take chances, but to be sure of a prompt result. However, from direct observation of the vesical neck through the suprapubic wound, it was obvious that the punch would do the job better than rongeur, knife, or scissors, particularly with the perfect control afforded by vision and touch through the opening in the bladder.

Case V.—This man was forty-two years old when first seen by me. He had had many attacks of gonorrhea. He complained to his doctor of pains, weakness, and stiffness of the thighs and calves. Wassermann reactions were negative and spinal fluid normal. Stricture was diagnosed and treated, with great relief of the leg symptoms. Frequency of urination was not noted until the doctor began urethral instrumentation, three to four months before I first saw the patient. At the time of our first meeting the patient was voiding about every two hours by day and two to five times at night. There were found several strictures of the penile and bulbous urethra which could be ultimately dilated with difficulty to F. 30. Residual urine varied from 35 to 45 c.c. on different occasions. Study of the vesical neck through the McCarthy cysto-endoscope showed a smooth prostatic border without intravesical lobes, a slight falling away of the posterior bladder floor above the prostate, and a deep depression of the floor of the posterior urethra just in front of the vesical neck.

I was in doubt whether the opening in the Young punch was long enough to grasp the obstructing bar, and hence preferred suprapubic exploration and the opportunity to remove the obstructing tissues completely. At operation an internal urethrotomy was first done to help the subsequent passage of instruments. After a suprapubic opening was made a tight bladder outlet was found. The punch instrument operated through the urethra met the requirements perfectly. Several pieces of tissue were removed, leaving a large opening with the floor of the bladder, the vesical neck, the posterior urethra on the same plane. The convalescence was satisfactory, the last urine coming from the wound on the eighteenth day, and the patient left the hospital on the nineteenth day. Subsequently the residual urine was nil, and the patient voided normal amounts at normal intervals, and with an ease not known for several years.

I have had similar cases of prostatic obstruction due to a median bar or contracted vesical neck, with no general prostatic enlargement, but with residual urine and the usual clinical picture common to all obstruction, in which the cystoscopic diagnosis was satisfactory and the width of the obstruction (as measured by manipulation of the cystoscope) known to be not too great for the Young punch. These types have been well handled by this method, and in well over twenty-five such operations I have not had an alarming hemorrhage. It seems unnecessary to take time to give illustrative case reports.

But I should like to add the case report of a man who had had three so-called prostatectomies, who obviously had had his fill of operations, but who still had frequency and residual urine due to the prostatic tissue remaining. He was made more comfortable with a reduction of residual urine by the removal of certain tissue by cauterization with the high-frequency current. This is a method of mechanical removal of obstructions which one should know, although its field of application is probably not large. I reported ten years ago (New York Medical Journal, July 26, 1913) complete relief of symptoms in men having large amounts of residual urine due respectively to contracted vesical neck and to a middle lobe. The method is feasible only with patients who tolerate the cystoscope well, and useful in those who refuse operation or who still have trouble after operation, as in the following instance:

Case VI.—This patient, seventy-four years old, had had a perineal prostatectomy ten years before he was referred to me, suprapubic prostatectomy eight years before, and another perineal prostatectomy six years before. He was voiding from 3 to 6 ounces of urine at a time and at intervals of from one to three hours; he occasionally dribbled a little, especially at night. The residual urine had been tested frequently and varied from 2 to 4 ounces. Cystoscopy revealed an irregular prostatic border, as is found in nearly all cases after prostatectomy, with a large nubbin in the left posterior aspect which would seem to be in position to fall over the vesical outlet during urination. On partial withdrawal of the cystoscope a median bar came into view. The man stood instrumentation particularly well and was very desirous to secure some measure of relief. I treated him six or eight times in three months, not doing too much each time. No particular discomfort and no bleeding followed the treatments except for the fact that epididymitis did follow one of the later treatments. This, however, subsided quickly. A decrease of residual urine to $\frac{3}{4}$ ounce and improvement of symptoms followed quickly. But the real interest centers in the late results. Observation two and one-half years later showed residual urine less than an ounce, and the amounts voided varied from 6 to 9 ounces, with a corresponding increase of intervals. The improvement as reported is not striking, but the increased comfort and better sleep afforded made the prolonged treatment worth while to the old gentleman.

My aim has been to point out the similarity of symptoms resulting from the various types of prostatic obstruction regardless of the pathologic change. Besides rectal palpation, careful study of the vesical neck by cystoscopic methods is necessary to afford full knowledge of the lesion, its form, and its pathology. And only with this knowledge can we select the proper method of affording relief. Prostatectomy by either of the usual methods is not only uncalled for, but will likely do no good in cases of contracture of the vesical neck. Yet with general adenomatous enlargement removal of only the most obviously obstructing part (*e. g.*, a middle lobe) will probably afford only temporary relief; a general prostatectomy is indicated. We must realize the necessity of leaving the vesical neck clear and large, for it is here that a small bit of tissue will do the maximum harm. If the trouble be only here (without general prostatic enlargement), the simpler methods applied through the urethra or through a suprapubic opening afford perfect results. Also, although general enlargement is evident, and requires prostatectomy, it is important to investigate the bladder neck digitally after the lobes have been removed to be sure that a small amount of tissue does not still remain to vitiate the final result. The occasional use of certain minor procedures with prostatectomy, or their subsequent employment to improve an unsatisfactory outcome from prostatectomy, will add materially to the ultimate comfort of the patients.

CLINIC OF DR. JOHN F. CONNORS

Harlem Hospital

GUNSHOT WOUND OF THE ABDOMEN

The first patient for this afternoon's clinic was brought to the hospital by the ambulance, having been shot twice, one bullet entering the body in the midaxillary line at the level of the tenth rib, the other entering the upper left quadrant. No history was obtained, as the patient was unable to speak English.

Physical Examination.—Patient is an adult white male, about thirty-five years old, well nourished, appears acutely ill, presenting the signs of shock and hemorrhage. The abdomen is rigid and tender throughout, the maximum point of tenderness being over the left upper quadrant. A shifting tympanitic note on percussion is indicative of fluid in the abdominal cavity.

Laboratory Findings.—Urine is negative.

Blood Count.—Leukocytes, 18,200; polynuclears, 81 per cent.; lymphocytes, 19 per cent.; hemoglobin, 74 per cent.

Remarks.—The patient was observed for two and a half hours before operation. Within this time the general condition was slightly improved, having responded to the routine treatment for shock. The blood-count and decrease in the percentage of hemoglobin were indicative of hemorrhage, and operation was decided upon.

Tentative Diagnosis.—Penetrating wound of the abdomen, involving gut and spleen and possible injury to the left kidney. The urinary findings were against the last condition. The diagnosis was arrived at by inspecting the wounds. The direction of the bullets was obliquely downward and inward for the one, and slightly downward and across for the other.

Operation.—A transverse incision is made at about the level of the two bullet wounds. On opening the peritoneal cavity free blood is present. Immediate evisceration of the small gut is now brought about. A rent in the mesentery is found which is bleeding profusely and which is ligated with a through-and-through suture. Three other perforations in the mesentery are treated in a like manner. Eleven perforations of the intestine are found, which are inverted with a single catgut suture (00 chromic). The suture included the serous and muscular coats of the intestine. On further examination a through-and-through perforation of the spleen is revealed, fortunately escaping the blood-vessels at the hilus. The left kidney is torn in several places and is surrounded by a large retroperitoneal hematoma. There is a tear of the liver to the left of the fissure of the gall-bladder which extends from the inferior to the superior surface. The tear is lightly packed with iodoform gauze, no suture is taken, as there are no signs of liver hemorrhage. A large pad is placed in the region of the left kidney and the spleen with the idea of controlling any capillary oozing which might subsequently arise in this region. The packing is removed from the liver, and as there is no further bleeding, the rent is not sutured or repacked. A counterincision is now made above the pubes through which a cigarette drain is inserted. The abdomen is closed in layers.

In discussing this operation several important questions arise:

1. Bullet wound.
2. Speed of operation.
3. Incision.
4. Evisceration.
5. Treatment of intestinal perforations.
6. Treatment of visceral injury other than gastro-intestinal.
7. Drainage.

1. *Bullet Wound.*—Careful inspection of the bullet wound gives the direction taken by the missile and whether it is one of entry or exit. The location of the incision is in part governed by this. Visceral injury can at least be tentatively diagnosed, regardless of the presenting symptoms and signs. Where there

are several wounds it is of great importance to know how many of these are of entry and exit. A concentric area of contusion and abrasion indicates that the bullet has taken a straight course (Fig. 250). If the area of contusion and abrasion occurs in a segment of the edge of the wound the area involved determines the direction of the bullet (Fig. 250, B to I). The opposite side of the contused area is always undermined. The undermining increases with the degree of obliquity (Fig. 250, J to L). The point of entrance is usually smaller than the caliber of the bullet. This varies with the different parts of the body, depending upon the elasticity of the skin and subcutaneous tissues. The type of the wound of exit varies considerably, depending upon several factors (deformed bullet, foreign bodies, clothing, bone, etc.). No area of abrasion is found.

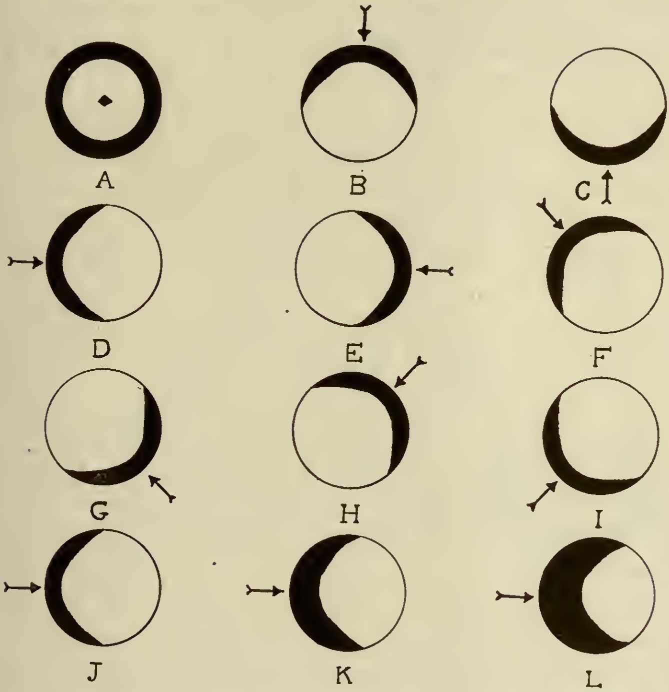

Fig. 250.—Arrow indicates direction taken by missile.

2. *Speed of Operation.*—This is one of the most important points in gunshot wounds of the abdomen. In few other conditions is the necessity of quickly entering and leaving the abdomen so essential. One must boldly and rapidly inspect and palpate the stomach and intestine and remaining viscera for injury, with immediate repair as the various lesions are revealed.

3. *Incision.*—In the past few years a transverse incision (Sprengel) has been employed in this clinic for various pathologic conditions in the abdomen. The ease with which the presenting pathology becomes accessible makes this incision a desirable one, and should, therefore, be more frequently used. Just recently it has been employed in several traumatic abdomens with great success. If a greater exposure is necessary the incision can be carried across to the other side, or a vertical incision up or down can be added. The location of the incision depends upon the bullet wounds as stated above. No postoperative hernias have been observed in the return clinics of the past few years. In this particular instance the incision was most ideal, as all the viscera could be inspected and palpated.

4. *Evisceration.*—This method has been employed as a routine procedure in all penetrating wounds of the abdomen at this clinic for some time. Numerous objections have been raised, the only one of consequence being the slight added shock of immediate total evisceration which is not sufficient to condemn it. The other method of gently pulling out of the gut loop by loop and returning the same probably produces as much shock. Furthermore, there is greater soiling and necessarily more handling of gut surface. Evisceration has the following points in its favor: That immediately after opening the abdominal cavity the perforations become extraperitoneal. The intraperitoneal soiling from the perforations of the small intestine is avoided. Inspection, palpation, and returning of the gut is greatly facilitated. The root of the mesentery can be thoroughly examined, likewise the remaining intra-abdominal viscera.

5. *Treatment of Intestinal Perforations.*—Layer suture is not employed, as it adds to the time element. All that is required

is a simple whip-over or a modified purse-string suture (Fig. 251).

6. *Treatment of Visceral Injury Other than Gastro-intestinal.*—Kidney injury is usually associated with a retroperitoneal hematoma. In most cases the hemorrhage is self-limited. Opening the blood-clot makes an ideal pabulum for bacteria, and the much-sought-for bleeding point, as a rule, is not discovered, and is, therefore, not recommended. Spleen injury: If the vessels of the hilus are injured or if the spleen is severely lacerated it is to be removed. Liver injury: A small rent is treated by light packing with iodoform gauze. If the hemorrhage is severe the rent is repaired with a mattress-suture, using a blunt, non-cutting needle. No traction or unnecessary pulling of suture is employed, and very little tension is made in tying the suture. Larger rents are treated in the same way, hemorrhage being the indication for suture. Iodoform gauze is preferable to plain gauze, as the former has greater hemostatic action.

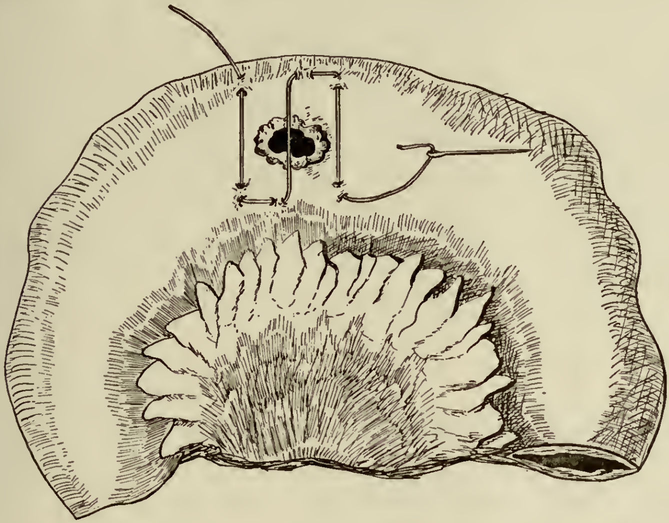

Fig. 251.—Intestinal perforation. Method of repair.

7. *Drainage.*—Pelvic and situ drainage are used in all cases six hours after injury, and earlier if some special indication arises.

Postoperative Course and Treatment.—The patient's temperature varied from 99° to 103° F. for the first week. From then on to the time of discharge it varied from 99° to 101° F. Pulse registered from 90 to 140 for the first week, and after that from 90 to 110. Routine shock treatment was instituted for the first forty-eight hours, after which it was changed to treatment for peritoneal irritation and mechanical ileus. Two days postoperatively the patient developed signs of a true mechanical obstruction, intermittent, colicky pains, vomiting, obstipation, and distention. In looking for the cause of the obstruction the possibility of the laparotomy pad left in the abdomen acting as a tumor pressing from without on the lumen of the gut was considered. This contention proved correct. The pad was removed, the pain ceased, and soon after a good result followed a colonic irrigation. The wound showed signs of infection of the sixth day and persisted until the time the patient left the hospital. The patient was ordered out of bed on the eighteenth day. On the thirty-third day the patient left the hospital, contrary to the advice of the attending surgeon, and has not returned to the follow-up clinic.

ARTERIOVENOUS ANEURYSM OF THE RADIAL ARTERY

This patient came to the hospital complaining of a painful swollen mass on the right forearm.

Previous History.—Irrelavent to present condition.

Present History.—Dates back two months prior to admission to the hospital, at which time patient sustained several severe cuts on the right forearm, following the breaking of a taxicab windshield. These lacerations were sutured by a physician. Two weeks later the patient noticed a small localized swelling at the site of the previous injury which she attributed to a piece of glass being left in the wound. This swelling gradually became larger and more painful. On date of admission patient first applied for treatment in the accident ward. The intern in charge, on ascertaining the history of pain and swelling, made preparations for the incision and drainage of an abscess of the forearm. Fortunately, just before incising supposed abscess he noticed an expansile pulsation. He then admitted the patient to the hospital. This illustrates the importance of always making a thorough examination.

Physical Examination.—The patient is an adult female, colored, about twenty-five years of age, well nourished, and apparently in good health. Further examination is negative except for several healed lacerations of the right forearm and a small pulsating mass 4 by 2½ cm. in size, on the anterior surface of the right forearm, midway between the elbow and wrist. There are no signs of inflammation. The radial pulses when taken are apparently equal. The mass disappears in part when pressure is applied proximally and distally to it. Expansile pulsation is present. On oscultation a bruit is heard.

Tentative Diagnosis.—Arteriovenous aneurysm of the radial artery.

Operation.[1]—An incision is made over the mass. A sac presents itself, which is dissected free. The artery and vein are exposed for some distance above and below the mass. A clamp is applied on the artery above its connection with the vein. Tributaries to the vein are ligated. The vein is now ligated above and below the sac, and this sac is incised longitudinally in such a way as to make a narrow and a wide flap (Fig. 252). The arterial clamp is momentarily released and a spurt of blood is noticed. The clamp is reapplied. The opening in the artery is exposed and sutured (Fig. 253). The clamp is again released, and, as no bleeding occurred, the narrow flap, *A* (Fig. 254), is placed over the sutured arterial incision. The wide flap, *B* (Fig. 254), is now folded over the narrow flap *A* and a layer of fascia, in turn, is placed over this flap and held in this position by two sutures. Silkworm-gut drainage is

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[1] Connors, J. F.: Jour. Amer. Med. Assoc., July 9, 1921, vol. lxxvii, pp. 118–121.

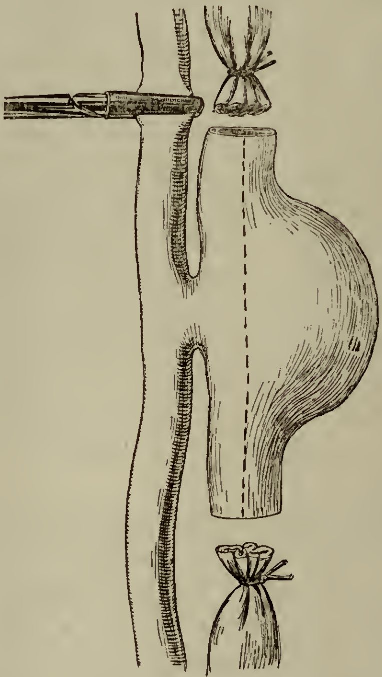

Fig. 252.—Clamp applied to artery, and the vein ligated above and below the connection; dotted line, longitudinal division of vein.

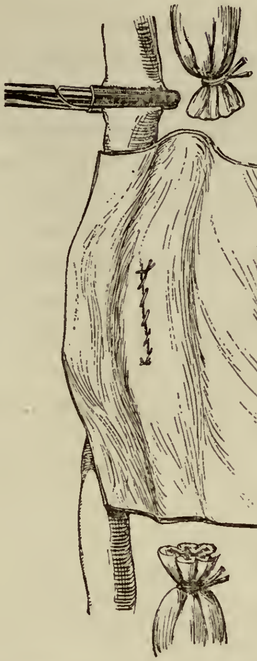

Fig. 253.—Vein opened, exposing the arterial connection which has been sutured.

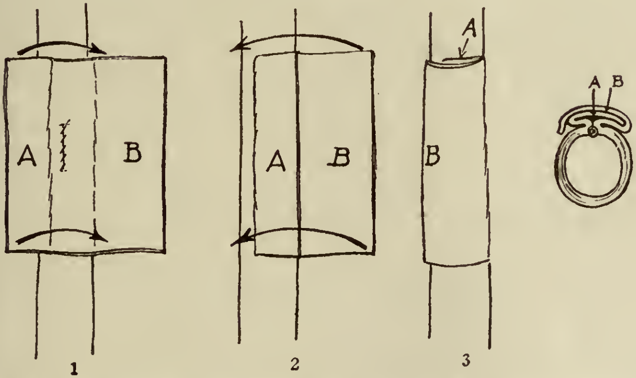

Fig. 254.—1, Suture completed; 2, narrow flap, *A*, placed over the suture line; 3, wider flap folded over narrower flap; 4, cross-section of operation completed.

inserted and four silkworm-gut sutures are used to close the incision.

In discussing this operation the question arises whether the operation just described has an advantage over the ligation of the artery and vein above and below the aneurysmal sac. Since the coats of the artery and the vein in this instance were not markedly damaged and the isolation of the sac was comparatively simple, this method of procedure was chosen. There is no doubt that the collateral circulation would have been re-established had a ligation of the artery and vein been performed. However, as a conservative measure it bears further trial, as the artery and vein may still be ligated at any time during the operation or subsequently if the occasion arises.

Postoperatively this patient made an uneventful recovery.

RUPTURED APPENDIX WITH GENERAL PERITONITIS SIMULATING RUPTURED GASTRIC ULCER

This patient was brought to the hospital by the ambulance, complaining of severe pain in the abdomen.

Previous History.—Scarlet fever, diphtheria, and typhoid as a child. Brazilian climatic fever during adolescence, also malaria. Gonorrhea and syphilis acquired during this period. General health is good.

Present Illness.—Two days prior to admission to the hospital the patient was seized with a severe pain in the epigastric region while sitting at the dinner table. Shortly afterward he vomited copiously, which relieved him somewhat. The pain has continued and has increased in severity and he has vomited several times since. At present the pain is general throughout the abdomen. The bowels have not moved since onset. The patient also complains of inability to pass urine. On catheterization 5 ounces were obtained.

Physical Examination.—The patient is an adult white male, about fifty-nine years of age, well nourished, and appears acutely ill. The abdomen reveals a board-like rigidity and generalized tenderness throughout, with maximum point of tenderness in the epigastric region.

Laboratory Findings.—Urine, negative.

Blood Count.—Leukocytes, 5600; polynuclears, 69 per cent.; lymphocytes, 31 per cent.

Tentative Diagnosis.—Ruptured gastric ulcer.

Operation.—A high right rectus incision is made. Free seropurulent fluid exudes as the abdomen is opened. There are no free gastric contents in the peritoneal cavity. Exploration of the stomach and duodenum is negative. The incision is now extended downward below the level of the umbilicus. The small intestine is distended and congested throughout. The appendix is now palpated. It is found to be freely movable, swollen, and points toward the spleen. On delivery the appendix is gangrenous throughout and ruptured at the tip. Several fecal concretions are felt within its lumen. Usual operation for removal of the appendix is performed. A cigarette drain is placed in Morrison's pouch and another is placed over the site of the appendix. A soft-rubber tube is inserted in the pelvis. Routine closure of the abdomen.

In discussing the case just presented the diagnosis is the all-important factor. Preoperatively ruptured gastric ulcer was the only lesion considered. One of the points against ruptured gastric ulcer was the absence of a previous history of gastric disturbances. This, however, has been observed in several other cases. The pain, which in the beginning was severe enough for ruptured gastric ulcer, became less severe, and then gradually increased. Usually the pain remains severe and lessens only after the patient becomes moribund. The board-like rigidity is characteristic. The blood-count indicates a lowered resistance. Tenderness over McBurney's point was no greater than over any other part of the abdomen except in the epigastric region, which further favored the diagnosis of ruptured gastric ulcer.

Postoperative Course.—Temperature remained 102° F. for four days, when it gradually returned to normal. The pulse never exceeded 110. The routine treatment for peritonitis and postoperative ileus was instituted. After a very stormy convalescence the patient recovered despite the fact that an unfavorable prognosis was given postoperatively.

Comment.—There were absolutely no symptoms, even in a carefully elicited postoperative history, which indicated that the appendix was responsible for the syndrome presented.

ACUTE HEMORRHAGIC PANCREATITIS SIMULATING HIGH JEJUNAL OBSTRUCTION

The last case for this afternoon's clinic was admitted to the hospital several hours ago complaining of pain in the epigastric region and vomiting.

Previous History.—Usual diseases of childhood. Menstrual history is negative.

Previous Surgical History.—At the age of five years the patient's back was broken.

Gastro-intestinal.—Appetite is good except for the complaint of eructations of gas after eating. For the past few years patient has had occasional griping pains after partaking of food. There was no time relationship between the pain and food intake. In the past few months these attacks have increased and have occurred mostly at night. The localization of the pain has always been in the epigastric region. No history of vomiting during these attacks. The bowels are irregularly constipated and, as a rule, considerable straining is necessary before evacuation occurs. Patient has never noticed any blood in the vomitus or stool.

Present Illness.—About thirty hours before admission the patient was seized with severe colicky pains in the epigastric region, which radiated to the left and up into the thorax. This pain has continued since as a dull ache, with acute exacerbations. With the onset of pain the patient vomited. This persisted for several hours and later occurred, when the severity of the pain increased. The bowels moved soon after onset of pain, but have not moved since. Several enemata returned clear. The abdomen gradually became distended. The patient also complained of intermittent attacks of dyspnea.

Physical Examination.—The patient is an adult white female, about thirty-two years of age, fairly well nourished and appears acutely ill. There is a slight cyanosis of the lips. The respirations are increased and slightly labored. This can be accounted for by the kyphosis and scoliosis which exist, as the heart and lungs are negative. On inspection the abdomen shows distention, which is verified by percussion. There is slight tenderness and rigidity over the entire abdomen and signs of fluid are evident. There are no masses palpable.

Laboratory Findings.—Urine, albumin and casts present, phenol and indican negative.

Blood Count.—Leukocytes, 24,100; polynuclears, 92 per cent.; lymphocytes, 8 per cent.

Tentative Diagnosis.—Acute intestinal obstruction.

Operation.—A median incision is made. On opening the peritoneal cavity a serosanguineous fluid escapes. The omentum is present in the operative field and is studded with numerous dull white patches. A small piece of omentum was removed for microscopic purposes. On further exploration the intestine is found to be distended and congested throughout and covered with small white patches. There is no evidence of a mechanical obstruction. The appendix and gall-bladder are normal. There are no signs of ulceration of the stomach or duodenum. The pancreas is swollen and indurated. Two cigarette drains are inserted and a soft-rubber tube is placed in the pelvis. Routine closure.

The interest in this case is from the diagnostic standpoint. The diagnosis of a hemorrhagic pancreatitis was suggested by the house surgeon, Dr. Alfred Cassasa, who based his diagnosis preoperatively upon the slight cyanosis which existed. At that time the cyanosis was attributed to the patient's physical deformity by other members of the staff. The classical pain of acute hemorrhagic pancreatitis which is supposed to be even more severe than that of acute ruptured gastric ulcer was absent. In favor of the diagnosis of high acute intestinal obstruction there is a history of cramp-like intermittent pain, vomiting, and obstipation. The distention favored both conditions.

Reviewing the case after operation the diagnosis of acute hemorrhagic pancreatitis with the clinical syndrome as was presented should have been included in the tentative diagnosis.

The similarity between high intestinal obstruction and acute hemorrhagic pancreatitis has been recognized clinically for some time. Some years ago Sweet et al[1] experimentally showed the close relationship between the two conditions. Dr. Eisberg,[2] one of my assistants at the hospital, has confirmed in part the previous work of Sweet et al. Just recently he (Eisberg[3]) has shown that an associated pancreatitis with a high intestinal obstruction experimentally produced increases the severity of the intestinal obstruction toxemia. Furthermore, when the pancreas was excised the symptoms of high obstruction were less pronounced.

Postoperative Course and Treatment.—Fluids were administered freely. Numerous high colonic irrigations were given, but with poor results. Gastric lavage was resorted to for persistent vomiting. The pain continued, but to a less degree. Pituitrin in divided doses and cathartics were given. Attacks of dyspnea occurred. Three days after operation patient succumbed during a convulsion.

Wound inspection postmortem showed the same pathology as found at the time of operation, with the exception of the increased pancreatitic activity within the peritoneal cavity.

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CLINIC OF DR. FREDERIC W. BANCROFT

NEW YORK HOSPITAL

THREE CASES OF BILATERAL TUMORS OF THE OVARY

Case I. Bilateral Papillary Cystadenoma of the Ovary.
Case II. Bilateral Edema or Elephantiasis of the Ovary.
Case III. Bilateral Dermoid Cysts.

THREE cases are presented because they show the tendency of tumors of the ovary to be bilateral, and the necessity, therefore, in certain types of ovarian tumors to perform a double oöphorectomy.

Case I.—A girl twenty years of age admitted to the New York Hospital, Second Surgical Division, on September 18, 1922.

Chief Complaint.—Swelling in the abdomen for four years. Patient has noticed this mass in her abdomen for four years, but during the last two weeks it has increased rapidly in size. She has had indefinite pain in her abdomen and back. Her menses began at fourteen years, were regular, every twenty-eight days, and lasted for four days. No pain. Gastro-intestinal: Occasionally vomits and for the last two weeks has suffered from diarrhea.

Physical Examination.—A large cystic tumor which extended well above the umbilicus was revealed. The tumor has a depression in the median line so that it feels almost as if it were bilateral. It does not move with respiration. There is tympany in the flanks and none anteriorly. The vaginal examination shows normal size uterus antiflexed, no bulging in the lateral fornices.

Double cystic congenital kidney was ruled out by the aid of cystoscopy and fluoroscopy. A barium enema reveals the colon normal in every way except that it is pushed out on both right and left sides by some mass. The transverse colon is high for the patient's habitus.

Operation (September 23, 1922).—A large ovarian tumor extending away up in the left intercostal region was removed through an excision extending from the pubis to about 3 inches above the umbilicus. The tumor was removed without aspiration, as it was thought possible that there might be a malignant intracystic papilloma. It is well known that if these cases are aspirated, implantation metastases may occur through leakage of the fluid. The tumor was then given to the pathologist, who found that it contained a papillary cystadenoma.

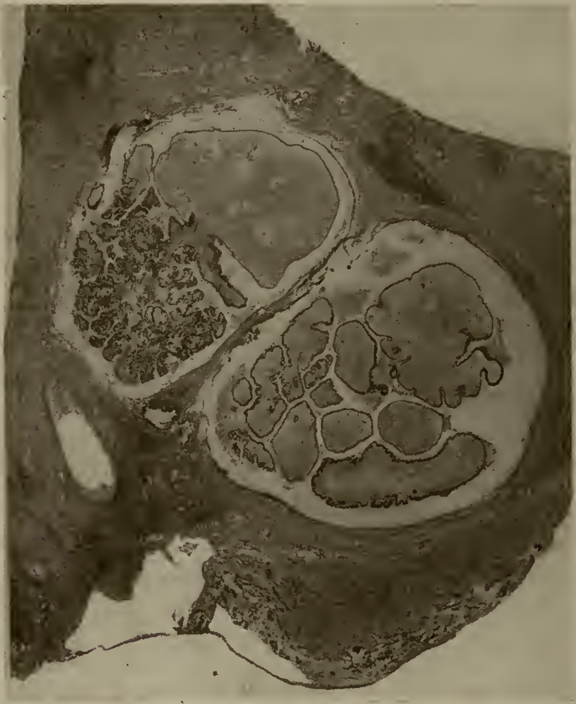

Fig. 255.—Low-power view of papillary cystadenoma in normal appearing ovary.

The other ovary was apparently normal in size and appearance. We know that papillary cystadenomas are apt to be bilateral, and study of our previous cases has shown that as a rule these growths occur in the other ovary and a second operation is usually necessary. For this reason the other ovary was removed, although it appeared normal and the woman was only twenty years of age. Upon examination in the pathologic laboratory the normal appearing ovary was found to contain a small papillary cystadenoma about 1 cm. in diameter close to the surface of one pole.

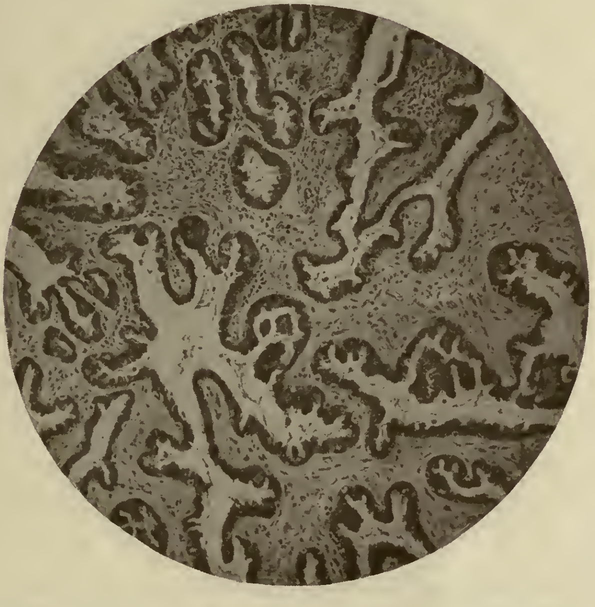

Fig. 256.—High-power view of structural papillary cystadenoma of normal appearing ovary.

Figure 255 shows a low-power section of the tumor mass in the normal appearing ovary. Figure 256 shows a high-power view of the mass in the normal appearing ovary, while Fig. 257 reveals the structure in the large papillary cystadenoma.

This case shows the absolute necessity of removing both ovaries even in young women with this type of tumor. It also shows the advisability of always removing, as far as possible, an ovarian cyst without previous aspiration.

Case II.—Bilateral edema or elephantiasis of the ovaries. Twisted pedicle on the right side.

Patient, J. L., age twenty-one, married, admitted to the Second Surgical Division, New York Hospital, September 22, 1922.

Chief Complaint.—Pain in the lower abdomen for twelve years.

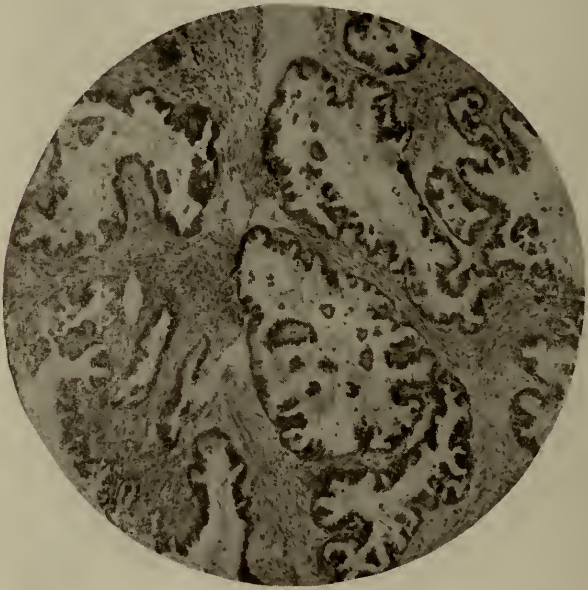

Fig. 257.—High-power view of papillary cystadenoma of large tumor.

Present Illness.—When in bed this morning the patient was seized with acute stabbing pain in her right lower quadrant. This was not constant, was cramp-like, coming and going momentarily. The pain radiates into the lumbar region. Patient has been spotting irregularly from the vagina for five months. Periods have always been irregular since their onset at eleven years of age. Patient has vomited twice since the onset of the present illness; the bowels moved today.

Past History.—Negative except that her periods have always been irregular, coming every twenty to ninety days. The flow varies from one day to two weeks. She thinks that her last regular period was two months ago in spite of the irregular spotting that has occurred for five months.

Physical Examination.—General examination negative. The abdomen shows moderate tenderness and deep palpation low down in the right side. Vaginal examination: The cervix is soft. The external os is patulous. The fundus is pushed posteriorly by a tumor mass apparently the size of a lemon which is anterior and to the right. This is excessively tender on palpation. The white blood-count is 12,000 with 86 per cent. polynuclears. The temperature on admission was 100.4° F.

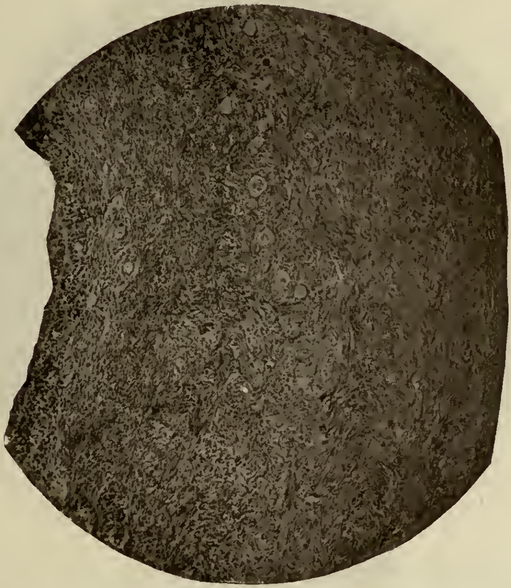

Fig. 258.—High-power view of case No. 256.

On account of the sudden onset of pain, the irregular menstrual history with spotting, the rather soft cystic, freely movable mass, diagnosis of unruptured ectopic gestation was made and an immediate laparotomy performed.

The right ovary was found to be a large solid mass about 8 cm. in diameter with a somewhat glistening surface and with the pedicle twisted three times, causing marked congestion. The ovary was excised, split open, and inspected. It was found to be solid on gross section and with a peculiar mucoid consistency. The left ovary was then inspected and found to be enlarged about four times the normal size and apparently involved with the same pathology as the right. There were several corpus luteum cysts in the mass, so that it was felt that all active ovarian tissue had not been destroyed by a tumor growth. Although it was a night operation, it was possible to obtain the services of Dr. Müller, the pathologist, and a frozen section was made of the excised ovary. The possibility of the tumor being a Krukenberg or sarcoma made it necessary for us to know whether it was absolutely necessary to·remove the second ovary. This we did not wish to do in a young woman unless it was absolutely necessary. Dr. Müller reported that the frozen section of the tumor showed a relatively normal ovarian stroma with marked edema. Therefore a partial resec-

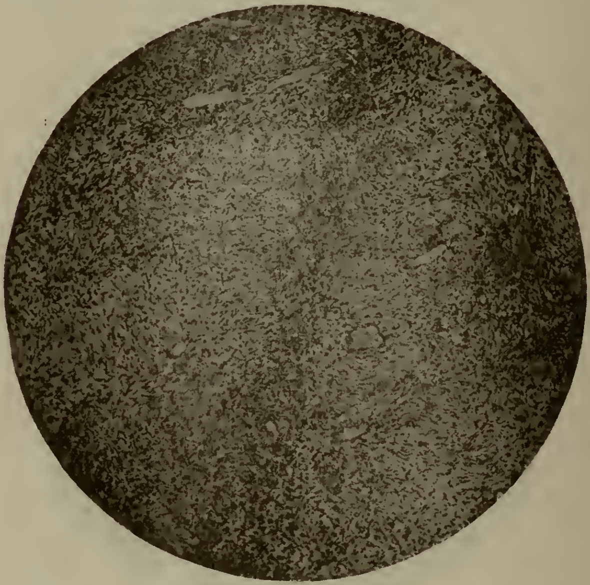

Fig. 259.—Showing marked edema of the ovarian stroma and the presence of graafian follicle.

tion was performed of the left ovary leaving a small margin of ovarian tissue which was closed with a fine chromic suture. Following is the pathologic report:

Edema of the Ovary.—There are two specimens: (*a*) an ovary 3 by 4 by 10 cm. The capsule is thick and smooth. Its consistency is soft. The cut surface shows many small (2 by 5 mm.) cysts situated in the periphery under the capsule. At one end several of these cysts contain blood and the stroma is infiltrated with blood. The entire ovary has a glairy, watery, clear appearance suggesting marked edema throughout, but most marked in the center; (*b*) one-half of a longitudinally bisected ovary. The piece is 1½ by 3 by 6 cm. Capsule, presence of the cysts, and the appearance of the cut surface are the same as in the other ovary, but there are no hemorrhages.

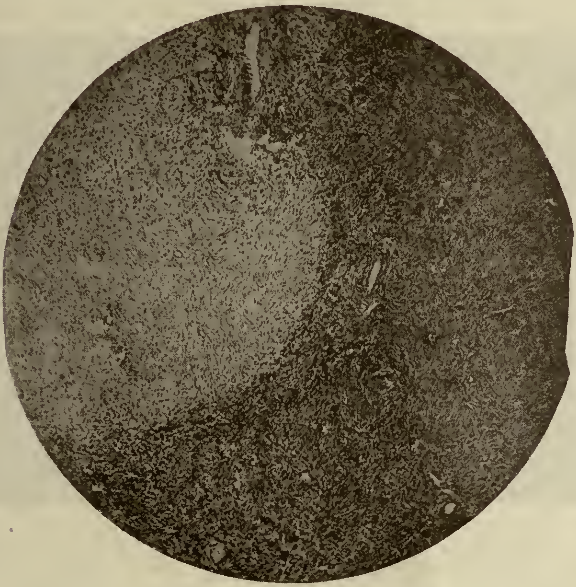

Fig. 260.—Showing marked edema of the ovarian stroma and the presence of graafian follicle.

Microscopic.—The sections so far examined of specimens (*a*) and (*b*) show the structure of an ovary with ova and follicular cysts normally distributed. The capsule is thick. There are many foci in the stroma, especially toward the center of the ovary, of irregular edematous areas. The stroma cells are separated by liquid.

This is a condition that I have not found described in the ordinary text-books on pathology, and it is difficult to understand either the etiology or pathology. If the same pathology had not occurred in both ovaries one might assume that the twisted pedicle on the right side had been the cause of the edema.

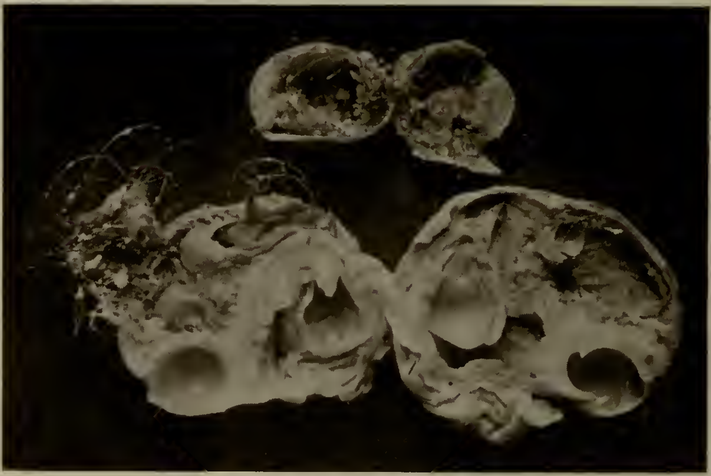

Fig. 261.—Photograph of small ovary showing presence of two dermoid cysts.

Figures 258, 259, and 260 show various areas of the tumor with the resulting edema. The presence of the pathologist and the feasibility of having an immediate frozen section made prevented a double oöphorectomy being performed. This patient was returned to follow-up about four months after operation and was in all respects well. Pelvic examination was negative.

Case III.—Dr. E. H. Pool has kindly allowed me to present this case as it bears out the necessity of careful inspection of the second or smaller ovary wherever a tumor growth occurs in one ovary.

The patient was a young girl fifteen years of age with a negative history except that for three years her parents had noticed an enlargement of the abdomen.

Physical examination revealed a large cystic tumor extending from the pubis to the umbilicus and more on the right side of the abdomen. Diagnosis of ovarian cyst was made and laparotomy performed.

On the right side a large dermoid cyst measuring about 30 cm. was found. This was removed and upon section showed the typical structure of an ovarian dermoid. The left ovary was then examined. It was found to be about 7 cm. long in its longest diameter and cystic. It was possible here to do a partial resection. It contained two small dermoid cysts as shown in Fig. 261. While dermoid cysts are usually single in each ovary, it is possible that several may occur in one ovary. In this case it is possible that a dermoid may develop in the portion of the ovary remaining, but a careful inspection of the remaining portion of the ovary failed to reveal any cystic structure.

The conclusions that may be drawn from this series of cases are: *first*, tumors of the ovary are very apt to be bilateral; *second*, wherever possible it is advisable to have a competent pathologist present with facilities for making a frozen section immediately at the time of operation. The majority of ovarian tumors have been so well classified and their malignancy or non-malignancy so well studied that upon receipt of a definite pathologic diagnosis we know whether to proceed with a complete extirpation of the ovary or to attempt a resection of the remaining ovary in a young woman; *third*, ovarian cysts should be removed *en toto* without aspiration of the fluid whenever this is possible.

THE SURGICAL CLINICS
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Volume 3 Number 3

CLINIC OF DR. EMMET RIXFORD

San Francisco Hospital, Stanford Division

CARCINOMA AT THE ILEOCECAL VALVE. CAPTURE OF A LOOP OF SMALL INTESTINE WITH OBSTRUCTION. A PROBLEM OF INTESTINAL ANASTOMOSIS

A man aged thirty-nine, giving a history of having had increasing abdominal discomfort for a year or more, which culminated four months ago in vomiting spells; particularly vomiting in the morning of food taken the night before. The vomiting attacks increased in frequency, vomitus finally becoming fecaloid. Spasmodic abdominal pain, chiefly central; sometimes felt radiating downward and to the left. Loss of 40 pounds in weight in four months.

Examination showed patient to be a middle-aged man, evidently underweight, abdomen moderately distended; exaggerated visible peristalsis in the small intestinal area. Apparently the whole small intestine would undergo a simultaneous periodic forcible contraction, forcing fluid and gas through the obstruction, with a gurgling sound. In the right abdomen at about the level of the navel a somewhat movable tumor of indefinite outline about 7 cm. in diameter. Occult blood in the stools. Wassermann reaction negative.

Provisional Diagnosis.—Carcinoma of the cecum, with obstruction of the small bowel.

x-Ray Examination.—It is interesting to note that *x*-ray examination with barium enema showed no abnormality in the outline of the colon or in its mobility. Some of the barium passed upward a short distance into the ileum. This finding was difficult to reconcile with carcinoma at the ileocecal valve causing obstruction of the ileum. The normal radiographic outline of the cecum and the passage of barium apparently through the ileocecal valve was almost enough to suggest that the tumor originated in and obstructed the small intestine.

Operation by median incision showed the tumor to be located at the ileocecal valve and to have captured a loop of the ileum, several feet higher up, causing obstruction of the proximal end of the captured loop. A portion of intestine between this point and the ileocecal valve was empty and collapsed. The explanation of the *x*-ray observation of the entrance into the small intestine of the barium was at once evident. It simply entered either through the ileocecal valve or through the other end of the collapsed loop of the bowel, probably the former.

The loop of bowel between the ileocecal valve and the point of obstruction was not only collapsed, but was hypertrophied. This indicated that at least in the earlier stages of the tumor there had been for a considerable length of time increasing obstruction at the ileocecal valve. After the carcinoma had captured the loop above and obstructed it, it had perforated at the point of obstruction, permitting a certain amount of drainage of intestinal contents directly from the proximal end of the obstructed loop into the cecum, and absolutely preventing any fecal matter from entering the loop below.

The absence of contents and, therefore, of demand for peristalsis, and absence of irritation of the surface of the growth at the ileocecal valve permitted subsidence of whatever part of the obstructing mass was inflammatory, and thereby opening up the ileocecal valve to a greater or less extent as shown by the entrance of barium from the cecum.

The ileum and jejunum from the upper point of obstruction were distended and hypertrophied so that the diameter of the lower loops was 6 or 7 cm. Numerous glandular metastases were found in the mesentery near the tumor, but the liver and other abdominal viscera were apparently free and, therefore, it seemed possible for surgery to give relief and possibly cure.

The anatomic condition may be diagrammatically represented in the accompanying sketch (Fig. 262). In the figure 1 represents the obstructed dilated loop; 2 and 3 the proximal and distal ends, respectively, of the collapsed loop; 4 is the transverse colon. The tumor is represented by the shaded area.

Five surgical procedures suggest themselves as possibly meeting the indications:

I. Lateral anastomosis of loop 1 to 4. That is, contraperistaltic anastomosis of the distended ileum with the transverse colon. This would meet the immediate indication of the rather high iliac obstruction, but it would throw out of function the loop 2 to 3 which was several feet in length and well worth saving. Of course, if cure were to be expected, a second operation of resection of the tumor and attached loops of bowel would be necessary.

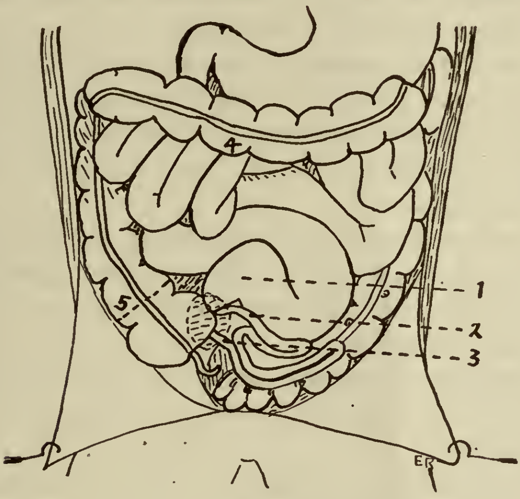

Fig. 262.

II. Contraperistaltic anastomosis of loop 1 to 2, trusting to the patency of the ileocecal valve to carry the contents into the colon. This procedure would probably be the most objectionable of all because loop 2 to 3, as said before, was hypertrophied, which could only mean that the ileocecal valve had been seriously obstructed. The powerful muscle of loop 1 would cause dilatation of loop 2 to 3, with almost certain perforation at the point of anastomosis.

III. Double anastomosis of 1 and 2 and 3 and 4 would meet the objections of the first and second procedures, but it would have objections of its own, namely, the anastomosis of 3 with 4 would probably seriously interfere with subsequent resection of the tumor. Moreover, both anastomoses would be contraperistaltic, and in the subsequent operation loss of considerable amount of small intestine from each of the three loops, 1, 2, and 3, would be inevitable.

IV. Resection of the tumor and the lower loop of the ileum by cutting across 1 and 4, closing the ends, and making an isoperistaltic lateral anastomosis of 1 and 4. This would seem to be preferable to either II or III, notwithstanding the sacrifice of the entire loop 2 to 3.

V. Resection of the tumor, preserving the lower ileal loop by cutting across 1, 2, 3, and 4, say at point 5, closing the ends of all four loops, making an isoperistaltic lateral anastomosis of 1 and 2 and of 3 and 4.

The choice of operations seemed to lie between I and V. I would be merely a palliative emergency measure; V an attempt at radical cure.

The above debate took but a few minutes, less than it takes to tell it. The anesthetist stated the patient was in good condition, thus far exhibiting no shock. It therefore was determined to attempt the cure by procedure V. Salt solution had been given at the beginning of the operation.

The four loops were rapidly cut across between clamps, the raw edges invaginated by linen suture. Great difficulty was encountered in removing the infected mesenteric glands without destroying the circulation to the small bowel. This was accomplished satisfactorily except for some venous obstruction, as shown by the hypertrophied loop 1 becoming cyanotic. It still bled, however, when scarified, and it was felt that because of the hypertrophy the circulation in the gut was much freer than normally, and would permit liberties to be taken not otherwise justifiable. It was simpler to remove the entire ascending colon instead of cutting it at 5. This further obviated the retention of a portion of colon above the anastomosis, which would otherwise remain as a blind sac likely to retain its contents.

A rapid lateral anastomosis was then made between 1 and 2 and 3 and 4. The patient manifested little evidence of shock until the work was being done on the mesentery, as if the traction on the mesentery were responsible. He became quite weak, but after closure of the wound regained consciousness, though did not recover from the shock. He died six hours after leaving the operating-room. There was little loss of blood.

In view of the outcome it is probable that the choice of procedure I would have been better under the circumstances, notwithstanding its disadvantages, and the necessity for a subsequent operation, although so great a length of the small intestine would have been thrown out of function as to make it doubtful whether the man would improve much in nutrition.

On histologic examination the tumor proved to be an adenocarcinoma and involved the ileocecal valve and the mesial wall of the cecum. The mesenteric lymph-glands contained numerous metastases.

If a given surgical procedure succeeds in solving a problem, and curing the patient, it is taken for granted, though it may not be true, that that procedure is the best that could have been devised. At least it is certain that it was adequate.

If, on the other hand, the procedure fails, it presents an obligation on the part of the surgeon to review the evidence in the case minutely in order to discover the cause of the failure and formulate a better procedure. We learn by our mistakes more than by our successes, so that it is more logical to publish our failures than our triumphs, to the end that others may profit by our mistakes rather than learn the same lesson by the sacrifices which are apt to be the result of their making the same mistakes.

CLINIC OF DR. FRANK W. LYNCH

UNIVERSITY OF CALIFORNIA HOSPITAL

VAGINAL REPAIR; UTERINE SUSPENSION; APPENDECTOMY

Our case this morning presents a number of most interesting gynecologic conditions and brings up several basic points for our consideration.

This patient is twenty-seven years old and has had an uneventful medical history until her marriage, five years ago. The family history is negative and her menstrual history has been perfectly normal until most recently. She has had 2 children, the elder of which was born spontaneously four years ago after a normal pregnancy. She wore no abdominal support during pregnancy. She says that the physician "took stitches" immediately after the baby was born. Three or four months after her labor the patient began to complain of backache and a sense of pressure in her pelvis. She sought no medical advice, however. She states that her obstetric physician made no pelvic examination after her discharge from the hospital. Three years later the woman again became pregnant and gave birth to a normal size baby after a labor of seven hours. Her pregnancy again was uneventful and she did not wear abdominal supports. The backache returned soon after delivery, and with it came bearing-down sensations and, presently, leukorrhea. She went to another physician, who told her that she had ulcers of the womb and a displacement, for which she took a long course of tampon treatment and local applications, without noticeable relief. She came under our charge two months ago. We replaced the uterus and inserted a pessary. Pessaries, however, have not held the uterus in position. She now presents with the above complaints and with the findings of a relaxed vaginal outlet, a lacerated and hypertrophied cervix, and an enlarged retroposed retroflexed uterus, for which she has come to operation. None of these findings can be cured without operation.

This pelvic condition is a frequent sequelæ of child-bearing. The chief interest centers in the condition of the cervix and the retroposition. The pathology in the cervix is self-evident. There is considerable discussion as to the significance of the retroflexion.

There is a school of surgeons that operate without hesitation any posterior displacement of the uterus on the ground that it is abnormal and is giving symptoms which, if not evident to the patient at the time, are nevertheless present and are inducing reflex disorders. This class of surgeons may do far more harm than good. Fortunately, they are no longer in the ascendency. We have very good proof that the position of the uterus is not the paramount issue, but that symptoms arise only from associated pathology which is not always present, but which, when present, will cause recognizable alterations in the uterus itself.

In another study we have shown that retropositions of the uterus corresponding to retroflexions or retroversions of the second and third degree were found in 41.1 per cent. of 1230 of my obstetric cases at some time during the year after confinement, and the etiology did not appear to be related to the number of children the woman had had, forceps delivery, or to relaxed vagina; that all of the displacements did not occur shortly after labor, but that they might come on as late as nine, ten, or even eleven months after labor. In fact, 24 per cent. of the entire series of 505 retrodisplacements developed the displacement after the fifth month postpartum. Moreover, only 32 per cent. of the 505 cases of retrodisplacement developed symptoms which could be ascribed to the pelvis, as did 10 per cent. of the 725 cases which presented normal uterine positions.

In another study we are attempting to ascertain the frequency of symptoms in women who have been known to have retroversions for several years and, although the study is not complete, it shows that women may have retroverted uteri for at least five or six years without symptoms, provided the ovaries and tubes are normal, that there are no varices of the broad ligament, and that there is little or no parametritis. We have found, moreover, that cases presenting symptoms due to the displacement uniformly show enlarged boggy uteri as secondary manifestations of the associated pelvic pathology. This woman had such a condition. We believe, therefore, that her pelvis is causing symptoms for which operation is indicated.

The outlet, as you see, is relaxed, and there is a moderate cystocele and considerable rectocele. One should estimate carefully both the amount of relaxation and the extent of necessary repair before this weighted posterior vaginal retractor further stretches the weakened perineum.

Just a word as to the preliminary preparation. The patient entered the hospital yesterday. She has not been purged. It is a barbarous practice to keep a patient awake the night before the operation with the cramps from an unnecessary purge. Purging, moreover, is not essential. The patient was shaved yesterday and the abdomen cleaned with water and soap, and then with alcohol. Last night she had some bromid. She had a soapsuds enema at 6 o'clock this morning. A few moments ago the vagina was washed successively with soap and water, $\frac{1}{2}$ of 1 per cent. lysol, and with 70 per cent. alcohol. The bladder was then catheterized and 30 c.c. of 1 : 200 silver nitrate solution was instilled as a safeguard against cystitis. The cleansing was done after the patient was asleep, since otherwise she is aroused from the morphinization and takes the anesthetic less readily.

We have seized the cervix with tenacula and pulled it down into direct view. Without much traction it comes into the vulval cleft, which shows that considerable descent has characterized the retroflexion. We shall curet the uterus, after dilatation with Hegar dilators, for purposes of exploration. We emphasize the importance of this measure. It may avoid many heartaches in case the woman became pregnant immediately after her menstrual period seventeen days ago, or in case she has an early cancer. We therefore curet as a routine procedure even if we do not suspect either pregnancy or a cancerous growth. The cavity is 4 inches long. This shows that the uterus is enlarged and that it is probably giving symptoms.

It seems difficult to believe that this big hypertrophied cervix has arisen purely as a result of these cervical lacerations which we see here and which occurred in childbirth. Yet such is the fact. The process, however, is rather indirect. Cervical lacerations heal rather slowly by granulation after labor. When they are deep they retard the involution of the uterus and constitute a portal of entry for parametrial infection. They split the cervix open and allow the lower part of the canal to become everted so that it presents as an erosion on the cervical lip. The everted tissue is covered only by a single line of high columnar epithelium. These cells are constantly bruised when the cervix is forced down on the posterior vaginal wall as the woman strains. The rectum lies immediately behind the posterior vagina and nearly always contains fecal masses that are responsible for much injury of the everted mucosa.

The cervical glands which open on the everted and neighboring surfaces become infected in turn. Their bottle-like necks become occluded and the whole gland becomes diseased. The cervix hypertrophies in response and contains numerous areas of round-cell infiltration. A parametritis soon develops which is characterized at first chiefly by induration of the uterosacral ligaments. The process soon extends to the base of the broad ligaments in severe cases. Sudden traction on the cervix in a case like this always occasions pain. The entire condition could have been avoided had the physician made a primary cervical repair at time of labor. Yet he probably was taught not to do so, and was told never to inspect the cervix or to sew it unless there was evidence that the cervical laceration was responsible for a considerable amount of hemorrhage. Some day all physicians will know enough to inspect the cervix as a routine after labor and to sew all cervical lacerations before repairing the perineum. If secondary cervical repairs were simple and satisfactory procedures there would be no need of urging primary cervical repairs at time of labor as a routine procedure. But secondary repairs are neither satisfactory nor simple. Resection is necessary in all cases, and there is some difference of opinion as to how valuable the resulting organ ultimately becomes. The subject of cervical resections has sprung up again recently with the introduction of an operation proposed by Sturmdorff. We have not become interested in it since we see it only as a non-essential modification of a very old method.

To effect cure it is necessary to remove this infected glandular tissue (Fig. 263). This can be accomplished by a number of methods, all of which are identical in their fundamental procedures. By the method of Martin we bisect the cervix in this fashion (Fig. 264). Traction of the tenacula opens up the cervical canal (Fig. 265) so that we can inspect it carefully and remove all tissues which do not appear normal (Fig. 266). See, we may cut transversely as high as necessary and get the maximum exposure. We can readily control the bleeding from the paravaginal vessels by transfixing sutures. A wedge-shaped piece is now taken from the anterior lip in this fashion (Figs. 267, 268). It removes all the diseased tissue in this area (Fig. 269). The vaginal flap is now apposed to the margin of the cervical canal by No. 2 chromic suture (Fig. 270). The process is repeated on the posterior flap. Closure is made as shown in Fig. 271.

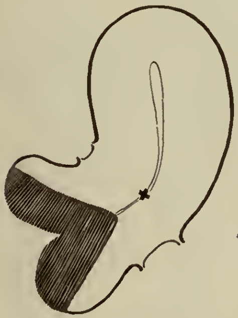

Fig. 263.—Endocervical resection. Shaded area outlines infected portion of hypertrophied cervix.

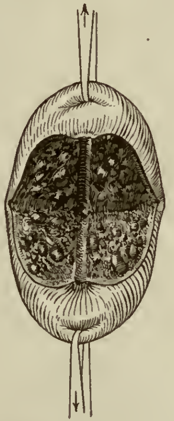

Fig. 264.—Endocervical resection. Cervix is bisected to expose upper limit of infected tissue.

As we have said, there are other methods which accomplish the same thing. Newman, now of San Diego, described some thirty years ago a method practically identical with that of Sturmdorff. Newman pulled down the infected tissues by transfixing the cervical canal with a tenaculum which he devised and

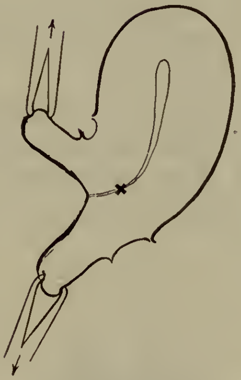

Fig. 265.—Endocervical resection. Lateral view after cervix is bisected.

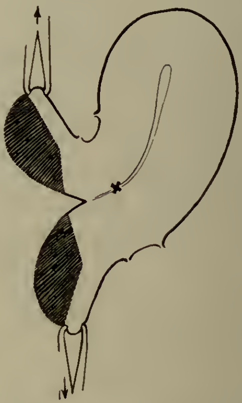

Fig. 266.—Endocervical resection. Lateral view showing area to be removed.

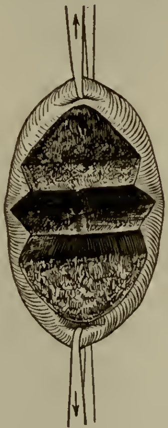

Fig. 267.—Endocervical resection. Cervix after bisection and wedge-shaped removal of infected areas.

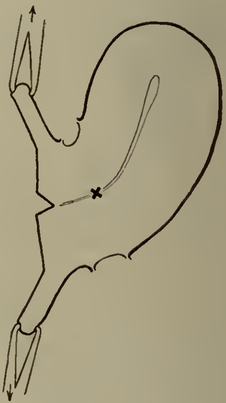

Fig. 268.—Endocervical resection. Lateral view after resection of infected endocervical tissues.

whose sharp points cross the midline like a diminutive letter T. He then cut out the infected areas with a right-angled knife devised for the purpose. Sturmdorff's operation is similar, save that a cone-shaped wedge is removed about the cervix instead of the two wedge-shaped sections of Martin's or Newman's method. We call attention to these variations in technic to emphasize the fact that they all plan for the removal of the diseased glandular tissues of the cervix. As you can see, this operation of Martin permits absolute exposure of the cervical canal. It does not prevent pregnancy or interfere with the course of labor.

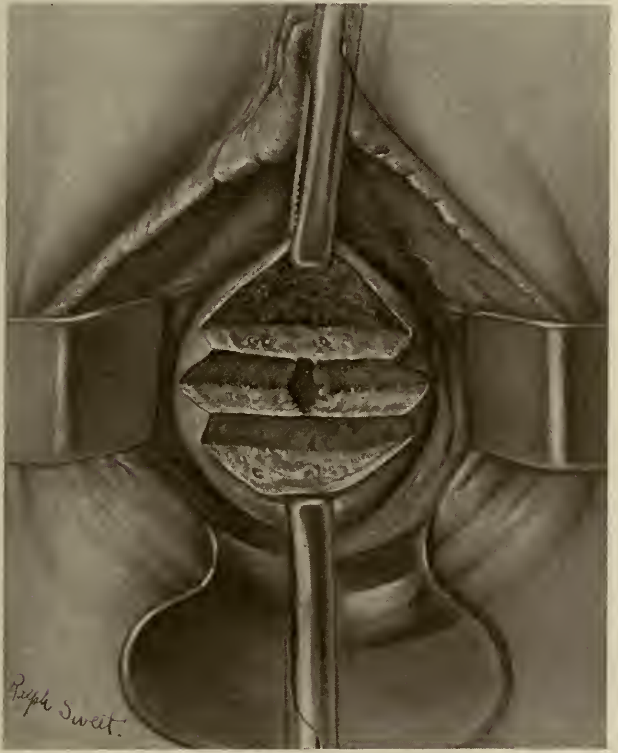

Fig. 269.—Endocervical resection. Denuded areas to be approximated.

We shall not discuss the vaginal repair at length except to emphasize the importance of the fascial support. Formerly men were afraid of the results of cystocele operations, and did not have a clear idea of the important steps of the operation, which then consisted in a removal of vaginal mucosa rather than a resection of hypertrophied fascia. The anatomy of this region was first ably described by the younger Martin, son of the one whose cervical operation we have just performed. Yet Martin's description of the fascia has not been as much responsible for the cure of moderate-sized cystoceles as the general adoption of the dissection scissors to open up lines of cleavage. Any one using dissecting scissors for the denudation of the vaginal mucosa will

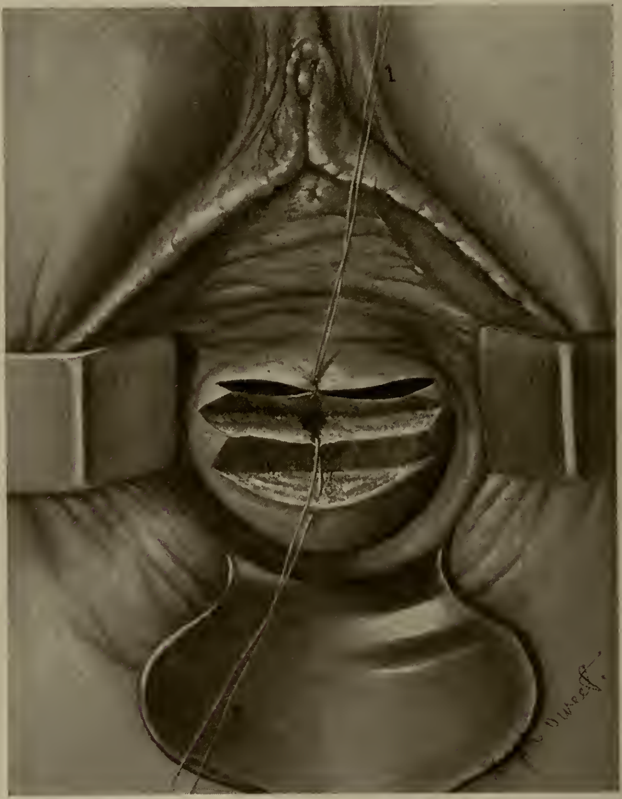

Fig. 270.—Endocervical resection. Chromic No. 2 sutures approximating canal and cut surface of ecrvical flap.

find that his plane of cleavage is *between* the bladder and the fascia, so that (often unconsciously) by the use of dissecting scissors alone the surgeon has prepared suitable flaps for the cure of the deformity. Personally, we favor, in addition to the fascial repair, the cystopexy idea of George Gray Ward, which, in effect, makes a bladder elevation, since it raises the bladder wall on to the anterior surface of the uterus and narrows the angle of the vesico-uterine plica and thus diminishes the force of the downward intra-abdominal thrust.

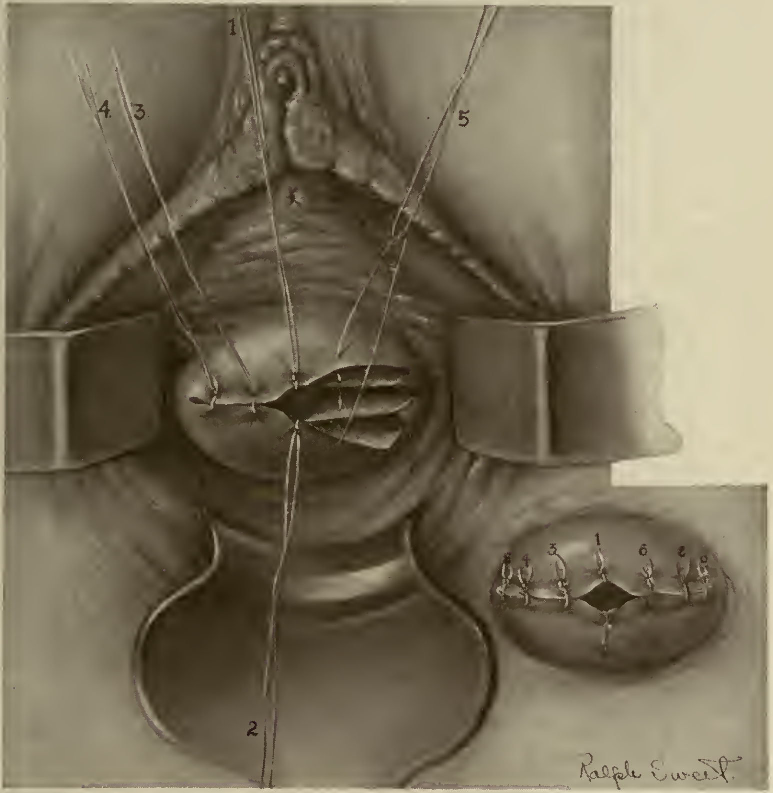

Fig. 271.—Endocervical resection. Placing of sutures to complete a new cervix. Appearance of cervical repair completed.

The rectocele operation is identical in principle and aids to shut off the hernia of the ampulla of the rectum through the weakened vaginal floor. We carry our incision high up—even as far as the cervix—prepare our flaps, and close with rectopexy sutures, as described in our clinic on prolapse (Surgical Clinics of San Francisco, April, 1922).

The abdomen is opened by a midline incision, reaching from the navel to the pubis. There are several small vessels immediately under the skin which sometimes bleed slightly. We will not ligate them, since this very slight bleeding from the wound will cease as soon as the abdominal retractors are in place. We now incise the fascia and expose the edges of the muscles so that in closure the cut edges of muscle and of fascia may be directly united. This reduces the ever-present chance of hernia in the wound. The peritoneum now lies exposed. We take a clean knife and forceps before incising it. Be careful when you pick up the peritoneum with your forceps that a loop of bowel is not included in the bite. Incise the peritoneum deliberately so as not to injure bowel. Before packing back the intestines we shall explore the upper abdomen. We record the exact findings in each case in our history of the operation. The self-retaining retractors are in place. You see the uterus lying back in retroflexion. The fundus is not in evidence, since it lies far down in the pelvis. The tubes and ovaries are likewise out of view.

You note the round ligaments running from the sides of the false pelvis to the region of the upper uterine margin of the bladder. In their outer third they lie embedded in the fascia and connective tissues, from which they project as a rather thin band, scarcely half again the size of an ordinary window curtain cord.

It seems unfortunate that no better structure than a round ligament is available to check the backward movement of the fundus. Experience has shown us, however, that if properly performed a round ligament operation will cure. It is less complicated, moreover, than plications of the base of the broad ligament, which do not always accomplish the purpose, and carries less risk than the theoretically sound operation of uniting the uterine portion of the uterosacral ligaments to the sacral periosteum.

Plication of the peritoneal aspect of the uterosacral ligaments does not cure.

The middle third of the round ligament is thicker. Here it lies in a distinct mesentery. Experience has taught us that a round ligament of this appearance is not likely to be firmly implanted in the inguinal ring. Even if we make a new fixation of the round ligament upon the uterus we know that the retroflexion will recur if the insertion of the round ligament in the groin is not firm. This case will probably call for a new attachment of the round ligament into the abdominal wall or groin. You see that the ligament is not firmly attached in the groin and pulls out to a considerable extent as we make traction upon it. The basic operations which fix the abdominal or groin end of the ligament are the Alexander and the Olshausen. We do not favor the former, since it necessitates other incisions and more dissection. The Gilliam operation and its modifications appear to us as variations of the Olshausen principle, differing from it only in technic. We shall fasten the round ligament in the groin by an Olshausen modification, but before proceeding to the operation let us examine the uterine end of the round ligament.

We have shown that in long-standing retroversions the round ligament often pulls out from its normal high insertion in the fundus, sliding down, as it were, to a point so low down on the uterus that forward traction on the ligament will not bring the fundus forward in anteflexion. If such a condition prevails, any new fixation of the ligament in the groin will not keep the uterus forward. A new uterine insertion will also be necessary. Let us ascertain the condition in this case. We will seize the midportion of the round ligament with these clamps and make a forward pull upon them to see if the uterus will come up into a normal anteflexion position. As we pull we see that the round ligament has a fan-shaped attachment on the uterus, and pulls chiefly from the lower band which is inserted in the uterus just above the vesico-uterine margin (Fig. 272). Even when we bring the clamps forward as far as the internal inguinal ring, the uterus does not assume a forward flexion, but lags behind because the main pull of the ligament is not upon the fundus. This is rather a common finding, yet it has occasioned remarkably little comment in the literature. The deformity has been found in at least 10 per cent. of our cases. We have shown that it accounts for most of the failures of men who do only one type of round ligament operation.

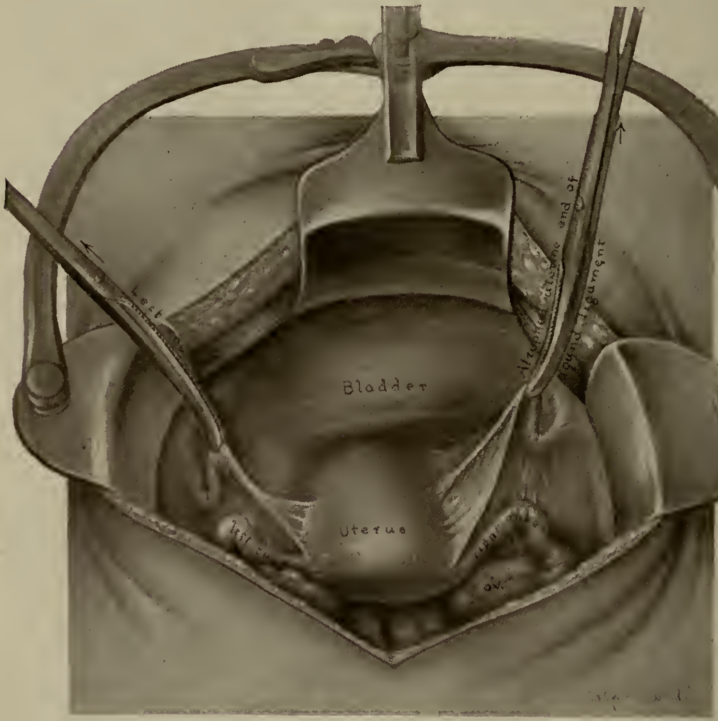

Fig. 272.—Atypical round ligament insertion in uterus. Forward pull on right round ligament fails to anteflex uterus. With fan-shaped attachment of the ligament the pull is not exerted upon the fundus.

This case, therefore, needs a new insertion of the round ligament both in the groin and uterine fundus. It is just as necessary as are the two supports of a hammock. The groin fixation is simple. Two purse-string Pagenstecher sutures will give a firm fixation. The other part of the operation is not so simple.

As we examine the appendages we see that the right ovary is prolapsed and that its ligament is twice its normal length, and that the veins in both broad ligaments are numerous and engorged. This suggests varicose veins of the broad ligament, but the diagnosis cannot well be made while the pelvis is elevated. It is best made before operation by examining the woman standing, a thing we neglected to do. Yet the case seems well suited for a Webster suspension because (1) the ovaries are fairly normal, although they contain many tiny cysts, a condition we shall disregard, (2) the veins are dilated, and (3) because a new uterine insertion of the ligament is needed.

No operation elevates the uterus as well as the Webster or secures such a normal anteflexion, features that are essential to the cure of the varicose veins of the broad ligament and prolapse of the ovary. There are objections to the operation only when done in ill selected cases and with a poor technic. It has not, however, come into wide usage because the proper technic is rarely described.

Before starting this operation we shall sew the round ligament as it comes out of the groin to the abdominal wall with two purse-string Pagenstecher sutures. The first bite of the needle takes the fascia on the lower border of Poupart's or just below it and mesial to the internal ring. The suture emerges just outside the bladder margin and, picking up peritoneum, transfixes the round ligament so that that structure will overlie the knot. The second suture is placed in the same manner. By so doing we avoid the larger vessels which lie external to the knots and the deep epigastric vessels which lie above it. This method advances somewhat the round ligament so that its pull is more anteroposteriorly than before.

The next step is the Webster suspension. While we hold the uterus with one hand, we thrust this long hemostat under the tube and ovary and close to the side of the uterus, through the broad ligament, to emerge on the anterior surface of that structure just above the round ligament. Be careful not to carry a blood-vessel on the end of the forcep or you may have troublesome bleeding. We nick the anterior surface of the broad ligament with a knife and let the forceps come through. With the hemostat we catch the round ligament very close to the insertion in the groin. There should be no more than 1½ inches of free round ligament between this new fixation at the groin and the bite of the clamp. This is most important for the success of the operation. The forceps is now pulled back through the broad ligament, carrying with it the doubled up round ligament. The free part of the latter structure is pulled through and held with shorter clamps for purposes of identification. We fix the round ligament on the posterior surface of the uterus just below the level of the utero-ovarian ligament, so that the round ligament runs straight and is not curved in a manner to compress the

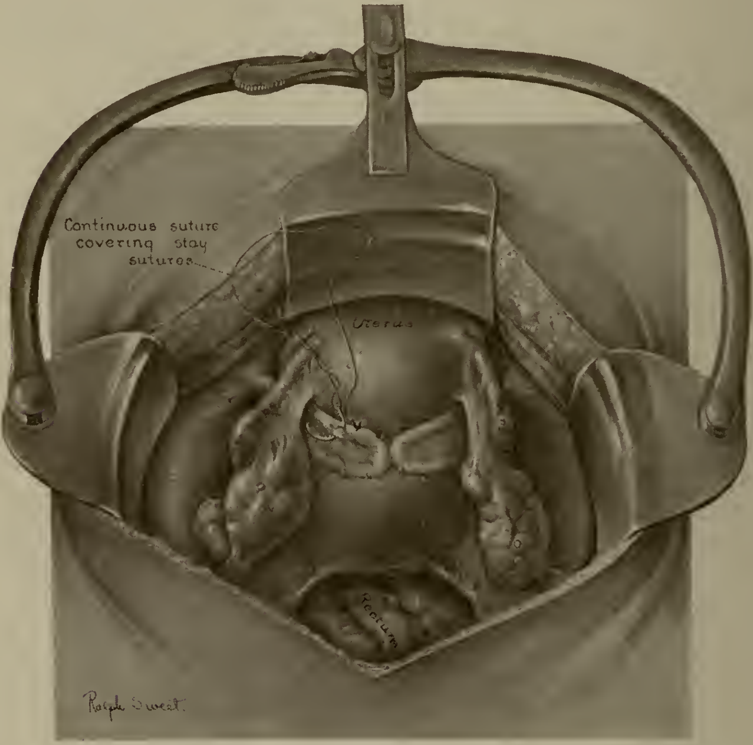

Fig. 273.—Webster suspension of the uterus. Note straight pull of ligament and its short free portion. The right utero-ovarian ligament is elongated. The uterus is elevated under symphysis. Interrupted anchoring sutures are of Pagenstecher. Figure shows beginning of peritonization.

ovarian or tubal circulation. The fixation sutures are Pagenstecher. Three or four are necessary on each side (Fig. 273). The first suture pierces the round ligament just where it was seized by the forceps that was thrust through the broad ligament. Do not remove the clamps until the suture is safely tied. The other fixation backs up the first one. The perforation in the broad ligament is now closed with Pagenstecher, the bite of the suture including the round ligament.

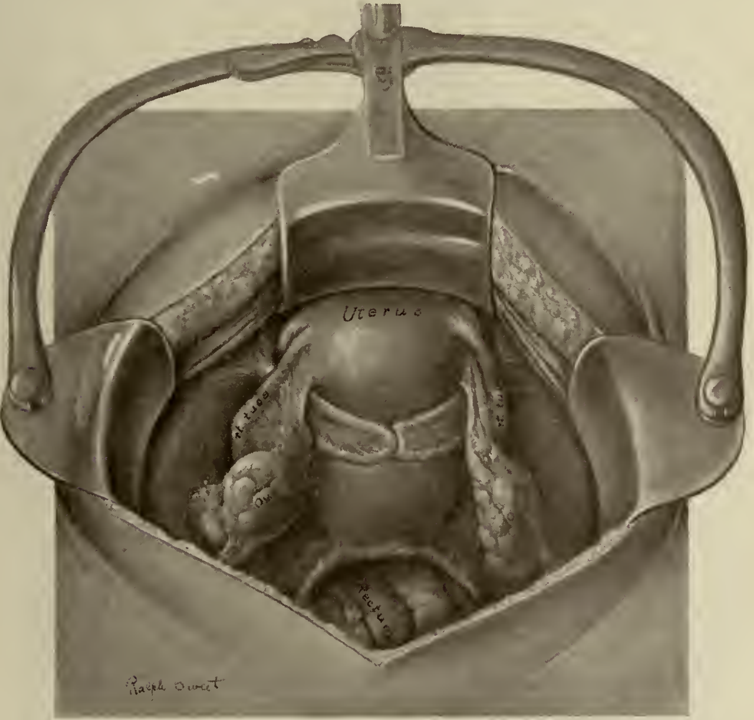

Fig. 274.—Webster suspension completed. Peritonization by non-irritating suture has covered raw edges with mesentery of the folded round ligament.

Now follows a most important step of the operation, which is to cover the Pagenstecher knots with a less irritating suture to reduce the chance of ovarian or intestinal adhesions. To that end we make a cover of No. 00 plain catgut, pulling up the mesentery of the round ligament as a cover for all raw surfaces (Fig. 274). The new insertion of the round ligament everywhere lies close to the uterus. There are no holes in which a hernia may develop. Occasionally we shorten the utero-ovarian ligament

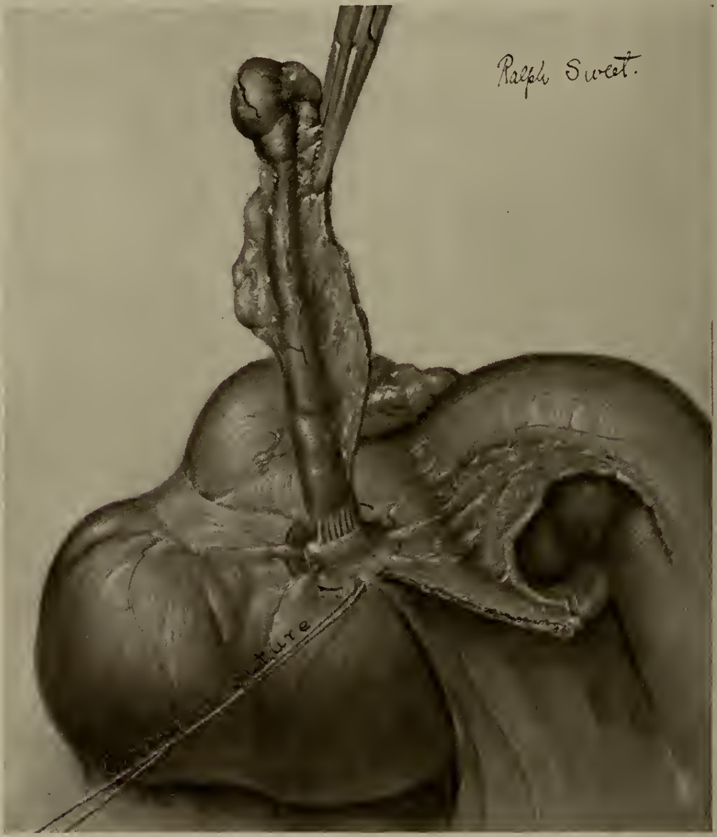

Fig. 275.—Peritonization of appendix wound. The meso-appendix has been ligated and cut. The base of the appendix has been crushed. A purse-string suture has been laid for the closure.

by including part of its margin in the suture. This aids in elevating the ovary. Often it improves the peritonization on the back of the uterus.

The uterus now rides well forward in anteflexion. It is freely movable, but springs forward when we release backward pressure on the fundus. There is only this inch or less of free round ligament anterior to the broad ligament. The ovaries hang suspended over the new round ligament fixation. The result is perfectly satisfactory. There are no raw surfaces to invite adhesions. The case can go through pregnancy. The obstetrician, however, should be urged to see that the uterus is kept forward postpartum.

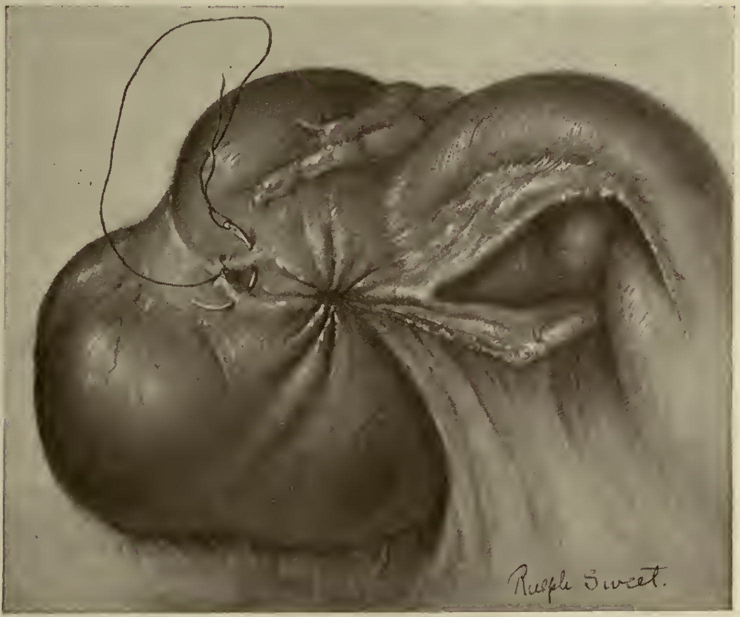

Fig. 276.—Peritonization of appendix wound. The continuous No. 00 catgut suture begins above the appendix wound.

While we are in the abdomen we should remove the appendix even though it is normal. Had the operation been extremely long, or if the patient were in bad shape, we should not do so. There is only one point in the appendix technic to which I would call your attention. It is the peritonization after the appendix has been removed and its stump has been inverted. The usual technic pulls the ends of the cut mesentery up and ties them over

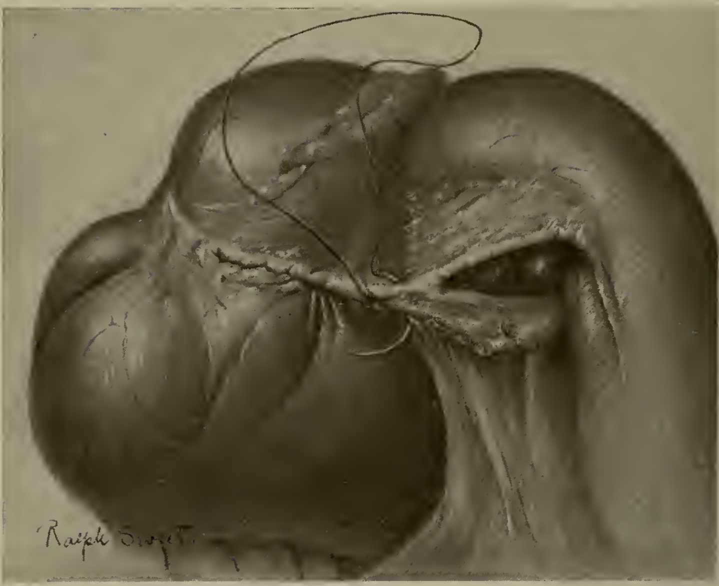

Fig. 277.—Peritonization of appendix wound. The continuous No. 00 catgut suture has inverted the edges of the cecum about the appendix wound.

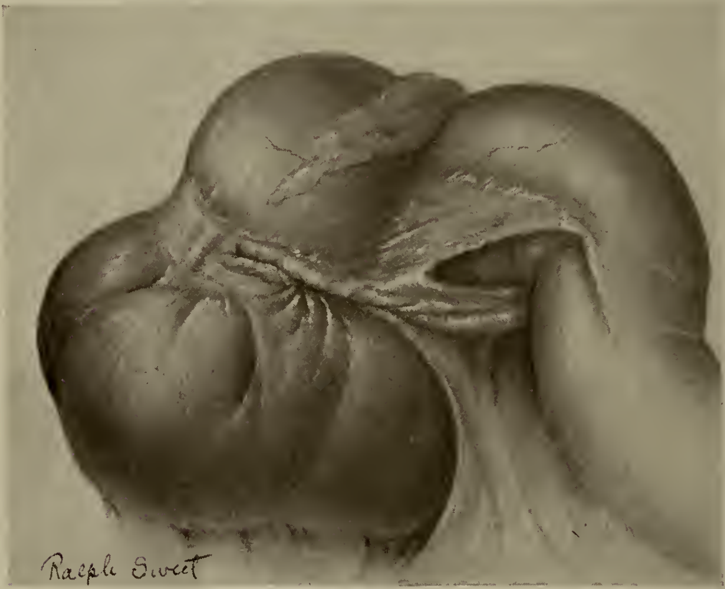

Fig. 278.—Peritonization of appendix wound. Inversion of the cut edge of the appendix mesentery completes the closure.

the appendix site with the second purse-string suture. We feel this method is not sound, since we have seen many intestinal obstructions follow such procedure. We make it a point to invert all our raw surfaces by a running No. 00 catgut suture after the usual purse-string of Pagenstecher has inverted the stump. This is well shown by the drawings (Figs. 275–278). The cut edges of the meso-appendix are inverted. Take care in this closure not to shorten the ileocecal fold and constrict the terminal ileum.

Preparation is now made to close the abdomen in layers, after all sponges and instruments have been counted.

CLINIC OF DRS. HAROLD BRUNN AND HOWARD FLEMING

San Francisco Hospital, University of California Division

CERVICAL RIB

Cases of cervical ribs are no longer considered rare or uncommon, but the condition is one well worth presenting for your consideration. It is surprising how often clinicians overlook cervical ribs as the etiologic factors in cases of brachial neuritis and other obscure diseases causing symptoms about the arms and shoulders.

The histories of the cases to be presented today are of three types: (1) A very mild case with a recent onset of symptoms, and not a subject for operation at the present time; (2) a case with a history dating back twenty years, undiagnosed until recently, discommoding the patient considerably, but not seriously, on whom operation is advised, but not yet accepted; (3) an especially interesting case on whom we shall operate, showing many severe vascular phenomena as well as an unusual distribution of nervous symptoms.

Case I.—This girl of twelve years comes to us with the complaint of a sprained shoulder. The patient was combing her hair and raising her right arm above her head. On doing so she felt a sharp pain in the neighborhood of her right shoulder. She was brought to the hospital because of her pain. An *x*-ray picture of the neck shows the cervical rib as pictured in Fig. 279. This is the first symptom that the patient has had, and it was relieved shortly after her admission by rest. No nerve or vascular findings are noted. In this case we shall allow the patient to return home, with instructions to report from time to time, before advising any operative procedure.

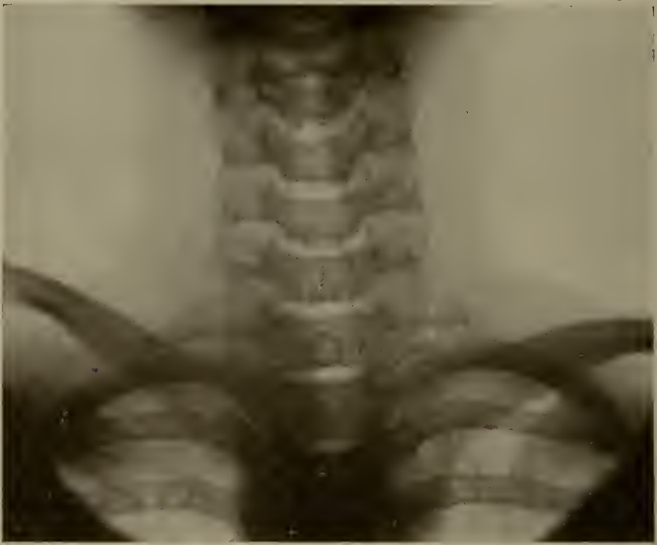

Fig. 279.—Case I. *x*-Ray showing a complete unilateral cervical rib on the right side. Slight symptoms.

Case II.—This case was brought before us through the kindness of Dr. Alson R. Kilgore. Patient is a man of forty, well developed and muscular, of stocky frame. Twenty years ago, when he was actively engaged in athletics, especially baseball and tennis, he was suddenly seized with pain in the right shoulder and down the right arm. He was supposed to suffer from a strained ligament, and was compelled to give up all forms of exercise in which the right arm was used excessively. The pain improved, but for years on unusual exertion it would recur. Six months ago, on attempting again to play baseball, he had a recurrence of all his early symptoms, with severe pain in the shoulder and down the arm, not extending, however, into the fingers. He finds that certain movements will bring on the pain, such as reaching forward with his arm. On putting on his overcoat it is necessary to put it on the affected arm first. He cannot sleep on the affected side, and finds that when in bed he must carefully place the right arm over the chest in order to be comfortable. The pulses are equal; no nerve changes to be found. The pain comes and goes very quickly and, therefore, he has no permanent disability. On the other hand, his ability to carry on exercises is considerably curbed, and in even the simpler things of life pain frequently is brought on. We would consider this case a fit one for operative interference. (The x-ray picture, Fig. 280, shows a complete cervical rib on the affected side, with an absence on the left side.)

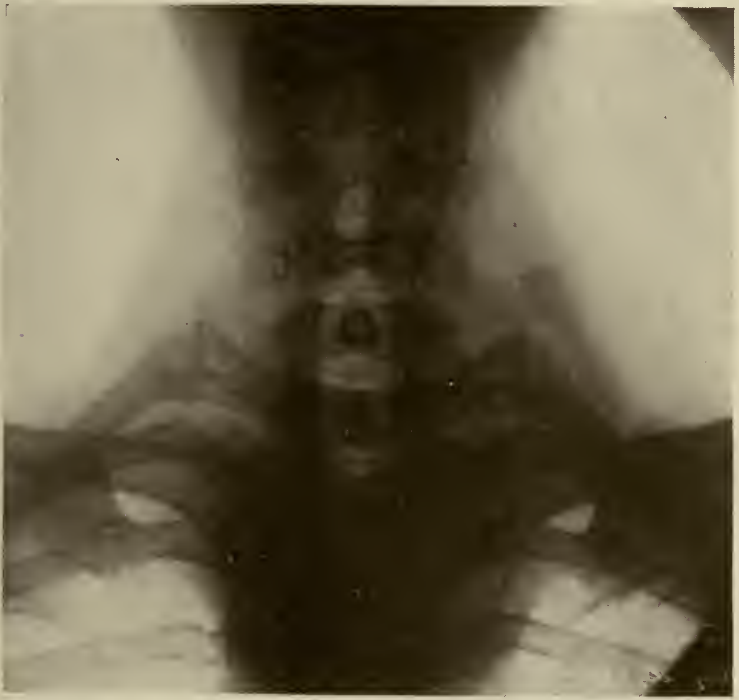

Fig. 280.—Case II. x-Ray showing unilateral cervical rib, complete.

Case III (Fig. 281).—Miss J. M., aged thirty, nativity English; waitress.

Complaint.—There is a feeling of heaviness in the entire right arm resembling a dead weight, blueness of the finger-tips, swelling of forearm and hand, with entire forearm and hand feeling numb and cold. Power to use hand diminished and there is a dull constant pain from the shoulder to the elbow.

Family History.—Father died at fifty-two years, cause unknown. Mother living and well, sixty years of age. Four brothers and three sisters, all in good health. Family diseases: There is no history of gout, diabetes, cancer, or tuberculosis. Father, while living, had frequent attacks of rheumatism. No one in the family has had any complaint of a nature similar to that which the patient has at present.

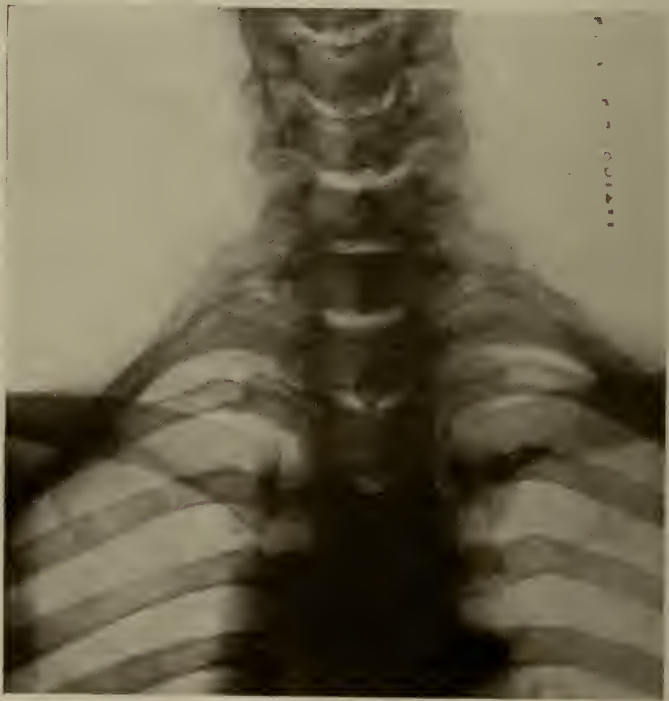

Fig. 281.—Case III. *x*-Ray showing bilateral cervical ribs, both complete. Symptoms on the right side only. (Operative case.)

Past History.—Of the infectious diseases of childhood, patient had mumps, chickenpox, and scarlet fever. Patient enjoyed good health as a growing girl. Gives no history of frequent colds or sore throats; has never been confined to bed with any serious illness.

Operations.—None.

Habits.—Sleeps well and feels refreshed in the morning. Appetite has always been good. Bowels regular. Two cups of tea at each meal. Alcohol, none.

V. D.—No history of G/C or lues.

Marital History.—Patient single.

Catamenia.—Menses started at sixteen years of age, in type very irregular; generally late; at the present time is twenty-eight-day type and regular. Flow always lasts from four to five days, moderate in amount. Pain severe in character during the first two days of menses, which necessitates patient's going to bed at times.

Present Illnesses.—In September, 1921 the patient was visiting at the Giant Forest, where the weather was rather cold, and at that time the finger-tips of her thumb and first finger of the right hand became blue, and gradually the other three fingers were included. There were no other symptoms at that time, and when the patient returned to her home in Hanford, where the weather is warmer, the blueness of her fingers disappeared. With the onset again of cold weather the thumb and first finger of the right hand again became blue, the other fingers being included, in addition to which the hand felt numb, cold, and useless. There was also a peculiar sensation in the right forearm. The patient consulted Dr. Lovas, of Hanford, who diagnosed cervical rib and verified the same by an *x*-ray.

Three weeks ago the finger-tips of the thumb and first finger of the right hand again gradually became blue; this blueness extended to the tips of the other fingers, and the hand as a whole was cold and numb, which feeling extended up the entire arm until patient's arm felt like a dead weight; while there was cyanosis of the finger-tips, patient noticed there was pallor present over the rest of the extremity and the ability to use the hand has been markedly impaired. In addition to the feeling of coldness and numbness, with blueness of the finger-tips, there is continual dull pain in the arm from the shoulder to the elbow, which has only been present since the onset of the last attack, Patient has noticed that the right hand and forearm is somewhat swollen.

Examination.—Patient is a young, well-developed and well-nourished woman, of athletic type. Her nervous system seems most stable. Pupils are equal and no hoarseness of the voice is noted. The thyroid gland is large but symmetric. No symptoms or signs of hyperthyroidism were elicited. Both supraclavicular fossæ are well filled out and on palpation a bony tumor mass is felt on the right, just external and above the sternoclavicular joint. The subclavian artery is easily palpable and gives the impression of being higher in the neck than usual, and more superficial. A distinct bruit and thrill are heard and felt. Pressure over the hard tumor causes pain to extend down the arm comparable to that given as a symptom. The course of the musculospiral nerve can be easily determined by the marked tenderness. The forearm is a trifle swollen, measuring 2 cm. more in circumference than the left. The hand is usually very pale, but occasionally cyanotic. The tip of the thumb, fore- and middle fingers are permanently and extremely cyanotic, suggesting an impending gangrene. The vasomotor reaction following pressure is extremely sluggish in the arm and hand and absent in the first two fingers and thumb. Allowing the hand to remain dependent or cold causes acute pain over the radial supply of hand and arm, overlapping to median distribution. On palpation the hand feels cold and clammy. The pulsation of the axillary artery can be felt high in the axilla, but no pulsation is palpable below. Blood-pressure: right, 130/70; left, 0/0. There is very marked paresis of the abductor muscles of the arm, the extensor muscles of the forearm, hand and fingers, and of the supinator muscles of the hand. A most marked hypesthesia of the radial distribution overlapping into the median distribution of hand and fingers is noted. There were no symptoms on the other side.

Dr. Callander kindly consented to examine this patient with a surface capillometer, observing the flow of blood in the capillaries of the thumb. It was noted that the blood-corpuscles flowed very slowly, practically at stasis, in marked contrast to the brisk flow noted in the left hand.

The patient's general condition is negative. There is no evidence of atavistic tendencies or congenital deformities. Due to marked exacerbation of symptoms and of impending gangrene of the fingers since her stay in the hospital, we feel that operation cannot longer be delayed for further study. (The *x*-ray plate of this patient (see Fig. 281) shows a bilateral cervical rib, but with symptoms present only on the right side.)

Operation (Fig. 283).—The incision which we choose to use in this particular case is of the so-called "hockey-stick" type, the vertical limb being along the anterior border of the lower third of the cervical portion of the trapezius, and the horizontal limb a little above the middle third of the clavicle and extending almost to the sternoclavicular joint. This incision gives us plenty of room and allows us to work both on the anterior end of the rib, where it is joined to the tubercle of the first rib, and also on its cervical end, where it is joined to the transverse process of the seventh cervical vertebra. This latter may be reached best through the intermuscular space between the levator anguli scapulæ and the trapezius (Fig. 284). This route gives better exposure to the cervical end of the rib than it is possible to obtain through the straight incision parallel to the clavicle. We tie off the external jugular vein and find lying on the fascia the descending superficial cervical nerves. Some of these are sacrificed if it is necessary to make room for the dissection. Coming down now to the pad of fat at the base of the neck, this is gently separated with forceps, so that the transverse cervical artery and vein are easily seen crossing the field. These are tied at either end. The dissection is carried backward sufficiently far to expose the trapezius and the spinal accessory nerve, which is seen coursing diagonally across the field (see Fig. 284). The dissection is carried forward to expose the posterior border of the sternocleidomastoid, which is retracted mesially so that the anterior scalene muscle comes into the field with the phrenic nerve coursing over it (see Fig. 283). The omohyoid muscle is now freed from the cervical fascia so that it can be retracted either upward or downward. The brachial plexus can now be seen coming out of the scalenus medius and crossing the operative field. In this particular case there seems to be an anomaly of the plexus in that the anterior and posterior cords are widely separated and the pressure of the rib seems to come upon the posterior cord, thus producing the radial distribution of pain rather than the usual ulnar distribution. The subclavian artery is developed just above the clavicle and, with the omohyoid, is retracted downward. In this case the rib is felt just between the anterior and posterior roots of the cord, and it is easy to retract the anterior roots upward and work between them, as seen in Fig. 283. The attachment of the scalenus medius to the first rib is severed completely. With the retraction of the upper end there is left, as you see, a large cavity behind the plexus, in the bottom of which the rib is felt. Part of the attachment of the scalenus anticus is also severed from the tubercle in order to expose the articulation of the rib at this point. This exposure gives us, as you see, an extremely good working space. The fibrous tissue and muscles corresponding to the intercostals attached to the first rib are now carefully separated from the cervical rib on all sides, being careful not to enter the pleural cavity. The periosteum is left on the rib. Following the rib backward through this approach it is easy with rongeurs to cut it off from the transverse process of the seventh cervical, and we do not find it necessary to make any other approach posteriorly in order to reach this end of the rib. Tracing the rib downward we find a synostosis between the seventh cervical and the first rib, which it is necessary to sever with a chisel. Just forward of this point and lifted upon it is one of the cords of the brachial plexus and the subclavian artery under tension. Although on examination it appeared possible that an aneurysm had formed on the subclavian, on account of the expansile pulsation that was felt we find no dilatation present. The partial separation of the scalenus anticus to the tubercle makes it easy to disarticulate the rib at the forward attachment where the joint had been formed, and the rib is now easily slipped out from under the plexus. The nerves and arteries drop into the large cavity left through cutting the scalenus medius. The cutting of this muscle is, therefore, advantageous and will not be reunited. Very little bleeding occurs throughout this operation, as you note, and we are able to close without drainage.

Note.—This patient left the hospital on December 7, 1923, fourteen days after operation. Her improvement has not been spectacular, but has been steady up to the present time. The arm was supported in an abduction splint for four weeks. Examination of the capillary flow in the vessels showed marked acceleration of the corpuscles following operation. The cyanosis gradually disappeared, as did most of her symptoms, especially the pain in the arm. In a note from her on March 8, 1923 she states that she is back at work as a waitress in a lumber camp; that her hand is still sensitive to hot or cold water and perspires freely; that the middle finger is still quite numb; that the nails are hard and brittle; but that she has no pain of any kind and is able to do her work. Although the strength of this arm is somewhat less than the other, she states it is improving all the time.

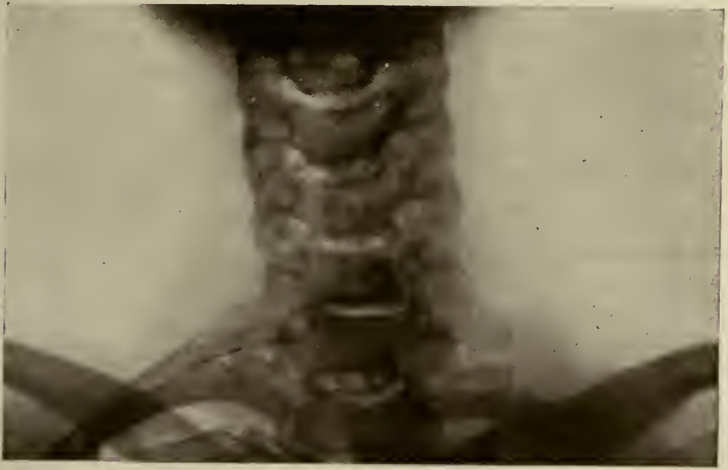

Fig. 282.—Same as Fig. 281. *x*-Ray after operation.

As previously stated, this case is interesting and instructive chiefly because of the marked vascular symptoms and the involvement of the posterior cord of the brachial plexus. A large majority of the reported cases had symptoms referable to pressure on the medial cord. Many text-books emphasize the ulnar sensory and motor disturbances as a characteristic feature of the cervical rib syndrome. Both the clinical picture and operative findings in this case demonstrate that the posterior cord was the one principally involved and the medial cord little if any affected.

Discussion.—The literature pertaining to cervical rib dates back two hundred years or more. Much has been written about the subject, and for those who are interested Streissler's "Die Halsrippen" is most complete and gives an excellent bibliography.

Cervical ribs are present in at least 1 to 2 per cent. of all subjects, as evidenced by careful autopsy examination. These vary in type and size, and the great majority cause no symptoms; 80 per cent. or more are bilateral, but, strange to say, 95 per cent. give unilateral symptoms only.

Many theories are advanced regarding the presence of cervical ribs. The most plausible and commonly accepted one is that cervical ribs are an evidence of atavistic or reversion tendency. Tredgold points out that the chimpanzee has twelve to thirteen ribs, and the lemur thirteen to sixteen poorly developed ribs. Capitan emphasizes that ostriches, dolphins, and porpoises have cervical ribs. In the human embryo twenty-nine pairs of rudimentary ribs are present, seventeen pairs disappearing before birth. All the cervical vertebræ have rudimentary ribs, those of the seventh cervical being the last to disappear. Supernumerary ribs have been described as arising from lumbar vertebræ. Inasmuch as these seldom cause symptoms, little attention has been paid to them.

The transverse processes of the cervical vertebræ differ from the others as they have foramina for the passage of the vertebral vessels. Unlike the thoracic vertebræ the lower cervical vertebræ have two centers of ossification, called anterior and posterior, that form the transverse process. Overgrowth of the anterior or so-called costal process results in a cervical rib.

For the purpose of description cervical ribs have been classified, and Gruber's classification is the one usually accepted. Class 1: Cervical ribs consisting of a node that does not extend beyond the transverse process. Class 2: A blunt projection of bone, 4 to 5 cm. long. Class 3: Ribs long enough to articulate with the first rib or attached to the sternum with a ligament. Class 4: Complete rib with vertebral origin and costosternal cartilage.

Cervical ribs are much more common in females, the literature giving 70 per cent. as the figure of incidence. Oftentimes other congenital deformities are present. Streissler states the occasional association of the cervical rib with spina bifida, harelip, cryptorchidism, dislocated lenses, club-foot, and congenital lipoma. Oppenheim includes cervical rib in the list of so-called stigmata of degeneration, and indicates that they may be a feature of an underlying neuropathic diathesis. Peter Bassoe reports 3 cases of syringomyelia in patients with cervical ribs. He urges that a careful scrutiny be made for evidence of hypochondriasis, psychoneurosis, multiple sclerosis, and unstable nervous system before operation is attempted. In 3 of his cases the operation was a surgical success, but all 3 patients were decidedly worse due to increase of their mental symptoms. This point is certainly well worth remembering.

The symptoms and signs of cervical rib are best classified under four heads—local, vascular, neurologic, and remote. All may be present, but usually only a few are outstanding. It has been stated that if the vascular symptoms are prominent, the neurologic are often absent, and vice versa. Our experience has been that nearly all cases present neurologic symptoms, and the more severe ones have vascular symptoms as well.

The rib and its attachments usually produce a perceptible fulness in the supraclavicular region. On palpation a bony tumor can be felt, which is fixed and hard. Pressure may cause pain simulating that given as a symptom. This no doubt is due to pressure on the brachial cord already under increased tension.

If the subclavian artery is involved a thrill may be felt and a bruit heard. The artery usually is felt well above the clavicle and feels more superficial than normal.

The neurologic symptoms depend on the parts of the brachial plexus pressed upon. The cords are the structures usually involved, and at a point between or below the scaleni muscles, the medial cord bearing the brunt of the trauma. Occasionally, as in the case reported in this paper, the posterior and upper cord are mainly involved. Careful consideration of the sensory and motor symptoms will place the pathology in the brachial cord, as contrasted with symptoms referable to peripheral nerves or brachial roots. The patient may complain of neuralgic pains, numbness, tingling, formication, ataxia of arm, and weakness. Examination may reveal various degrees of hypesthesia, more rarely hyperesthesia or analgesia. The nerves and muscles supplied may be painful to pressure. Individual muscles or muscle groups may be extremely weak and muscle reflexes diminished. Atrophy of skin and muscles and change in tone and elasticity are often outstanding features.

The vascular symptoms if present often are the dominating feature. Whether they are due to direct pressure on the subclavian artery by rib or muscle, or to vasomotor disturbance by pressure on brachial cords, is a debatable question. Telford reports 2 cases in support of Todd's theory. Both of these cases showed marked vascular symptoms, with signs of impending gangrene. Ample exposure at operation revealed no pressure on the subclavian artery. The removal of ribs and the relaxation of brachial cords effected marked improvement and eventual recovery. Many writers have reported cases where the pressure on the subclavian had almost obliterated the lumen, and in some cases a dilatation was produced distal to the point of pressure. Halsted reports experiments on animals reproducing similar conditions.

The patient may complain of slight coldness in the affected part. Cold weather often excites an exacerbation of symptoms. The fingers and hand may exhibit a definite pallor, and return of color after pressure may be extremely tardy. Often erythematous patches persist, to be followed by a dry gangrene of the finger-tips. The pulse may be obliterated as high as the subclavian artery, and the blood-pressure diminished markedly. Signs of pressure on the subclavian vein are very rare, but marked edema and cyanosis have been noted.

Under the title of "remote symptoms" we include those due to pressure on the sympathetic system, such as unequal pupils, endophthalmos, signs of hyperthyroidism. Pressure of the recurrent laryngeal nerve may produce hoarseness, and spasm of the diaphragm has been reported as due to pressure on the phrenic nerve by a cervical rib.

Cervical ribs have been reported as the predisposing cause of several cases of apical tuberculosis. On the other hand, apical tuberculosis with retraction of the dome of the pleural cavity have been mentioned as the exciting cause of cervical rib symptoms. Cervical scoliosis is a condition frequently associated with cervical ribs.

The diagnosis of cervical ribs is usually not difficult if the condition is borne in mind. Trostler, a roentgenologist, reports a series of 65 cases in which the clinical diagnosis was correct in but 26 per cent. Brachial neuritis and progressive muscular atrophy head the list of mistaken diagnoses. With the aid of *x*-ray the proper diagnosis is made much more simple. One must remember, however, that frequently cases with short bony projections have cartilaginous or tendinous prolongations that provoke symptoms, but do not appear on the *x*-ray plate. Law emphasizes this point and reports 4 cases where the *x*-ray plates showed no cervical rib in patients with marked cervical rib symptoms. Operation revealed ligaments extending from the transverse process of the seventh cervical vertebra to be inserted at the scalene tubercle, costoclavicular ligament, sternoclavicular and interclavicular ligament. The brachial cords and arteries were stretched over these ligaments and under marked tension. If the symptoms strongly suggest the cervical rib syndrome, and all other conditions are ruled out, operation is permissible and advisable in spite of a negative *x*-ray picture.

Sir Harold Stiles has pointed out that pressure of the normal first rib may also be a predisposing factor in the etiology of brachial neuritis, and has described an operation for the partial removal of this rib, citing a case where relief has been obtained. The pressure of this rib may, therefore, be the cause of recurrent symptoms in cases that have not been cured.

In addition to conditions mentioned above, the diagnosis of cervical rib has been confused with malformation of the first thoracic rib, osteomas and exostoses, tubercular lymphoma, aneurysm of subclavian, Raynaud's disease, poliomyelitis, and arthritis. Brewer reports a case where an operation and extensive resection of the clavicle was far advanced, believing the case to be one of osteosarcoma before the true diagnosis of cervical rib was made. It is interesting to note that in 1893 Lewis Jones reported several cases of atrophy and sensory disturbances in the hands of young people, that he ascribed to a neuritis. In 1905 Thorburn reported 4 similar cases due to cervical ribs. Following Thorburn's publication Jones re-examined 14 of the cases previously reported as due to neuritis, and found 10 to be cases of cervical ribs.

Two interesting points regarding cervical ribs are the questions: why they occur so much more frequently in women, and why symptoms usually do not appear until young adult life or middle age. The first may be considered inexplicable. Several suggestions are offered regarding the second. Many patients date the onset of symptoms to the time of some accident or trauma to the neck and shoulders. Wearing a heavy neck yoke, the repeated trauma of carrying and firing a gun, have been given as etiologic factors. A plausible explanation is that when the structures of the body begin to lose their elasticity increased pressure is excited with a decreased amount of resiliency, thus producing symptoms.

Treatment is largely surgical, but in those cases so mild, or in cases complicated in such a manner as to preclude operation, medical procedures may be tried. Frequently the patient is made more comfortable by wearing any one of the variety of abduction shoulder splints. In a few cases abduction increases the symptoms. It is not uncommon to find that the patients themselves have found the position of comfort, especially when they are lying in bed, as noted in Case II. In mild cases the patient will usually appreciate a frank statement regarding his malady, and will co-operate with the surgeon. If the condition grows steadily worse and medical treatment proves unsatisfactory, he readily accepts operation.

Three methods of approach are described. The posterior route, as described by Streissler, has only been tried by himself on a few cases. The approach is difficult and need not be described except to say that with the patient in a sitting position an incision is made about 2 cm. parallel to the spine, opposite the vertebral prominence, extending a handbreadth up and down. The usual methods of approach are anterior; the one parallel to the clavicle and about a fingerbreadth above it; the other a vertical incision along the trapezius muscle, or a combination of the two. When the rib is short it is unnecessary to make an incision parallel to the clavicle. The vertical incision along the trapezius gives an easier route to the vertebra, and the brachial plexus is practically undisturbed. (Fig. 284 shows this incision.) The brachial plexus is well in front, the line of approach passes through the intermuscular septum between the levator anguli scapulæ and the scalenus posticus directly backward to the transverse process of the seventh cervical. To reach this point from in front requires retraction of the plexus and possible injury by pressure. When the rib is complete, however, and articulates in front with the sternum or the scalene tubercle, this incision is not sufficient, and a combination of this with the longitudinal incision is advisable. This is the so-called "hockey-stick" incision. In our particular case it was not necessary to use the posterior end of this incision, as it was easy to reach the cervical attachment of the rib through the anterior part. This may not always be so easy, and a portion of the rib may be left, which continues to cause pressure. (Fig. 283 shows the exposure with the "hockey-stick" incision.) In neither case is the scar disfiguring. No important anatomic structures need be sacrificed. Careful dissection is necessary to avoid injury to subclavian vessels, dome of the pleura, brachial cords, phrenic and spinal accessory nerves. Traction on the brachial cords must be very gentle, as any undue roughness will cause a tremendous amount of postoperative pain and a great increase of nerve symptoms. Passing a broad piece of tape about the plexus or individual cords and using that for traction purposes is a useful safeguard. In some cases the rib is reached most easily by retracting the plexus downward and mesially, in which case the suprascapular nerve may be injured. In other cases it may be retracted upward, or again the operation must be carried on by separating the

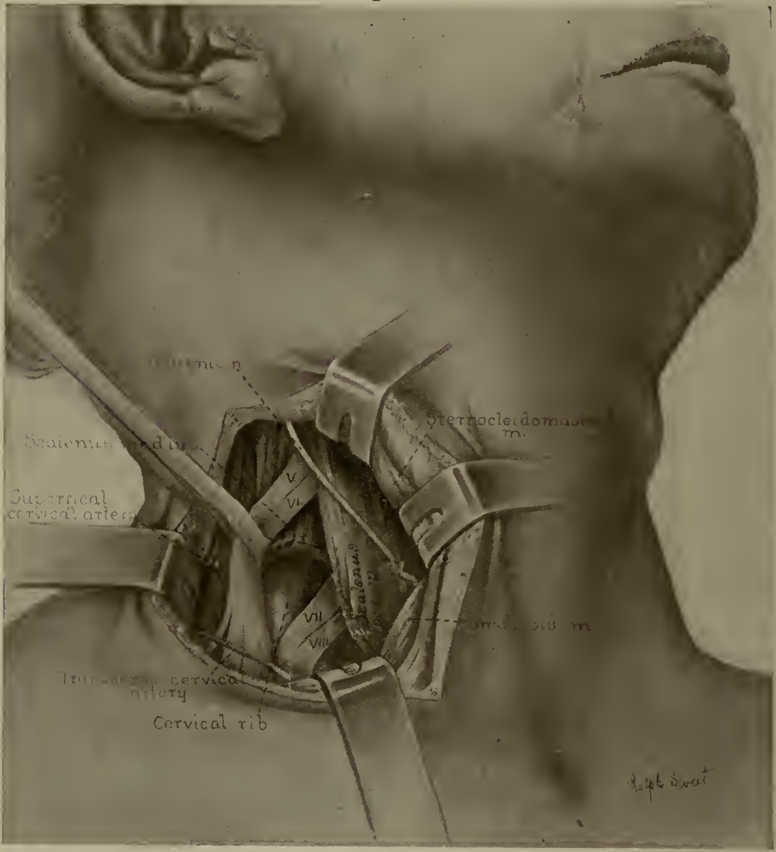

Fig. 283.—"Hockey-stick" incision for approach to the cervical rib.

two cords and working between them, as was accomplished in the case presented to you.

Most authorities insist on taking the rib out with the periosteum intact to prevent a recurrence. If this is possible without danger of opening the pleura it is an added precaution. The pleura has been opened during this operation several times without serious results, but it is to be avoided. To remove the rib subperiosteally is much more simple and has given excellent results in a great many cases. The rib should be cut off as far

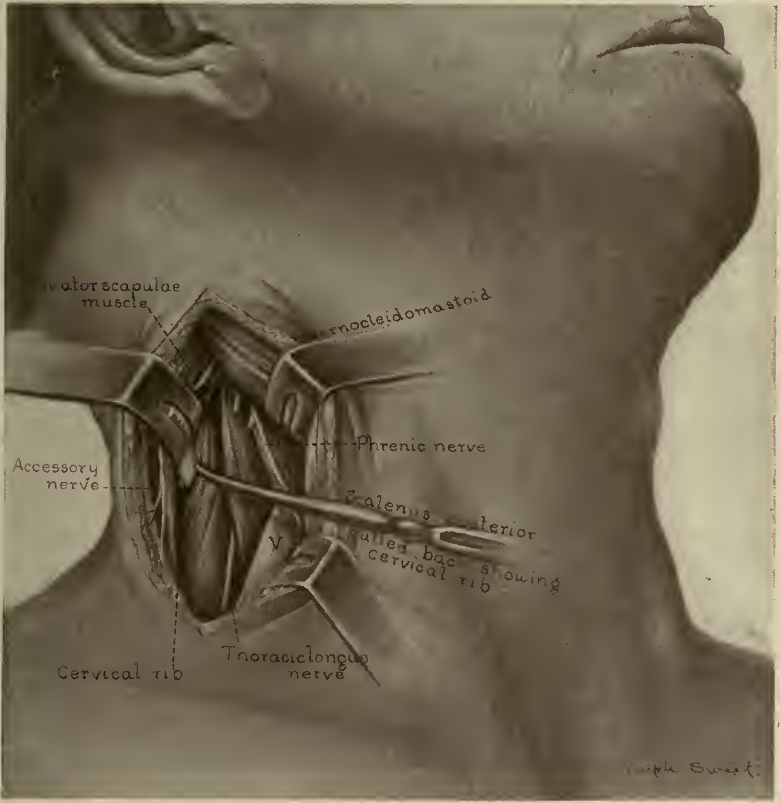

Fig. 284.—Perpendicular incision along the trapezius between the levator anguli scapulæ and the scalenus posticus.

posterior as possible and the stump carefully rounded off. The anterior attachment, if any, usually offers little difficulty.

As a rule, the patient does not obtain the maximum relief for ten to twenty months. In vascular cases thrombosis of vessels has often resulted and compensatory circulation must be established. Extreme care and gentle handling of the nervous tissues is repaid by a shorter period of convalescence. A few cases are not benefited by surgical measures. The reason may be mistaken diagnosis, undue trauma to tissues, incomplete operation, or unusual scar formation. However, the great majority of cases do well, and are greatly improved, and the surgical removal of cervical rib must be classed as one of the satisfactory surgical procedures.

CLINIC OF DR. JOHN F. COWAN

Stanford University Hospital

EXCISION OF THE KNEE-JOINT

Excision of the knee-joint for active disease, tuberculous or non-tuberculous, for arthrodesis, or for the correction of a deformity the legacy of an ancient pathologic process, results in the majority of cases in firm union between femur and tibia.

In cases where no special attempt at arthroplasty is made osseous union is the condition sought. That osseous union occurs in the majority of these excisions is easily demonstrated by stereoscopic roentgenograms in which bone trabeculæ may be traced from femur to tibia.

There are, however, certain cases in which, while union is firm, stereoscopic roentgengrams show no trabeculæ continuous from one bone to the other, but instead an irregular zone of lessened density between the bones. This is interpreted as a firm fibrous union.

Lastly, a still smaller number of excisions result in varying degrees of motion between the bones, and in these, definite clefts or spaces are seen in the stereoscopic plates. These are cases of loose fibrous union with cavities between the bones, the formation of a nearthrosis.

That the difference in end-results is not due to infection is shown by the following facts: (1) that all cases have healed *per primam*, (2) that any one of these results may occur where excision has been performed for the correction of a deformity resulting from an old traumatic or infective arthritis many years previously, or after attempts at arthrodesis for flail joint following poliomyelitis, and (3) that union frequently becomes osseous in cases of excision of the knee for tuberculous or chronic pyogenic arthritis, altough one feels that at the time of operation all infective material has not been removed.

On the assumption that the excision of the normal knee-joints of healthy dogs would result in bony union between femur and tibia a series of experiments was undertaken in collaboration with Dr. L. W. Ely, with the idea of studying the histologic changes in the bone and marrow leading to such union.

In this series of 19 excisions we obtained bony union in only 2 cases, and in these the union was between a small extent only of the sawn surfaces.

In 3 specimens there was firm fibrous or fibrocartilaginous union, in 8 a loose fibrous union, and in 6 a definite new joint with cartilage and synovial membrane.

As we had to deal here with normal tissues, as all operations were done under strict aseptic conditions, and as all wounds healed *per primam* with a minimal amount of inflammatory reaction, it was apparent that the variation in end-results was not to be attributed to infection.

A second series of excisions of the knee-joints of dogs was therefore undertaken to determine if possible the causes of these variations; and as bony union was the end-result sought, we endeavored to determine the factors essential to bony union and the best methods of securing them.

It is to be noted in the first place that the end-results obtained in the first series, namely, (1) bony union, (2) firm fibrous or fibrocartilaginous union, (3) loose fibrous union with or without clefts lined by a tissue resembling synovial membrane, and (4) a definite new joint are the possible end-results following fractures of the long bones, and it is quite apparent that the many etiologic factors given for the above conditions, including a great variety of systemic diseases as well as local infective and non-infective inflammatory conditions, do not obtain in cases of excision of the knee-joint in dogs.

It is to be noted, also, that such local conditions as interposition of the soft parts, disturbance of the blood-supply of one or both bones, or we may even assume disturbance in calcium or phosphorus metabolism, general or local, did not account for the large percentage of failures in bony union in the first series, for in each of the six excisions of the second series bony union was readily obtained between the entire or greater part of the sawn surfaces.

Failure in bony union, therefore, must be due to local factors which are easily controlled.

Our problem in these excisions is the securing of bony union between femur and tibia. As most of the operations in the human are performed for tuberculous arthritis, arthroplasty is contraindicated. Even in cases in which the indications for arthroplasty appear clear, the reports of end-results generally have not been encouraging, or at least have not given us a clear idea of the final results, which can only be judged after a lapse of years.

Arthroplasty requires a wide experience in the selection of cases, a mastery of surgical technic, and a thorough knowledge of physiotherapeutic methods, which but few surgeons possess.

The end-results must not be judged alone by the amount of motion obtained, for in the knee-joint, to a greater degree than in other joints, good stability, a fair resistance to hard work, and painlessness are factors quite as important as motion.

Recent reports, notably by V. Putti, of Bologna, show the possibility of creating new knee-joints which possess excellent functional qualities and are painless, and which even after many years do not lose their power; but a bony ankylosis in good position is always preferable to a painful, slightly movable, and an unsteady pseudarthrosis.

Before considering the process of healing by osseous union and the causes of failure of such union which result in the several types of fibrous union, we shall describe briefly specimens illustrating these different types.

In Dog 8, Series 1 (Fig. 285). Removal of 9.5 mm. of bone and cartilage from the tibia and 16.5 mm. from the femur.

Extremity immobilized by plaster-of-Paris spica for fifty-four days. After four hundred and thirty-two days microscopic examination of specimens shows the bones united by bone, but across only about the central third. The anterior and posterior thirds are united by fibrous tissue and fibrocartilage.

The fibrocartilage is next the trabeculæ connecting the two bones, while the fibrous tissue, greater in amount, occupies the periphery, and its bundles of dense avascular collagen fibres are directed parallel to the sawn surfaces of the bones and are continuous with the fibers of the fibrous layer of the periosteum.

This tissue appears to have arisen by an ingrowth from the periosteum. As a definite bone buttress has developed separating the marrow spaces from the fibrous tissue, and as the marrow is fatty, it would seem that the healing process is at an end.

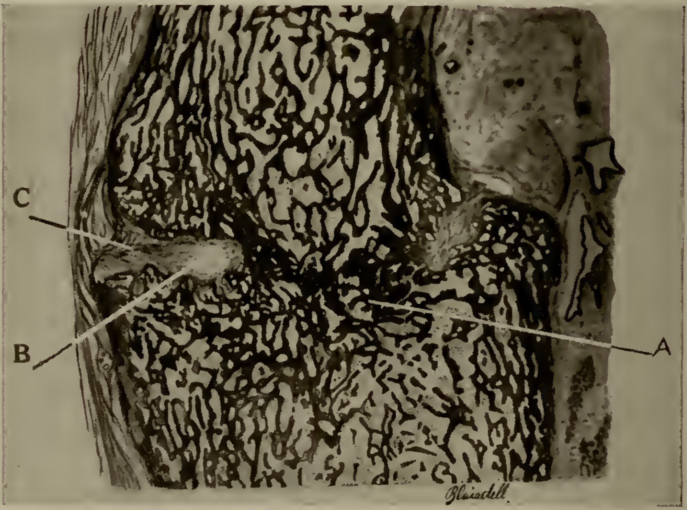

Fig. 285.—*A*, Bone trabeculæ uniting bones; *B*, fibrocatrilage; *C*, fibrous tissue ingrowth from periosteum. Note buttress of bone separating marrow spaces from uniting fibrous tissue.

Dog 4, Series 1 (Fig. 286). Removal of small portion of each bone. Immobilization sixty-nine days. After one hundred and twenty-two days microscopic examination of specimens shows end of femur irregularly convex, while that of the tibia is concave. The bone ends are covered with hyaline and fibrocartilage, and between them there is a layer of dense avascular fibrous tissue the collagen bundles of which lie for the most part parallel to the bone ends, and are continuous with the periosteum.

Irregular clefts are seen between cartilage and fibrous tissue

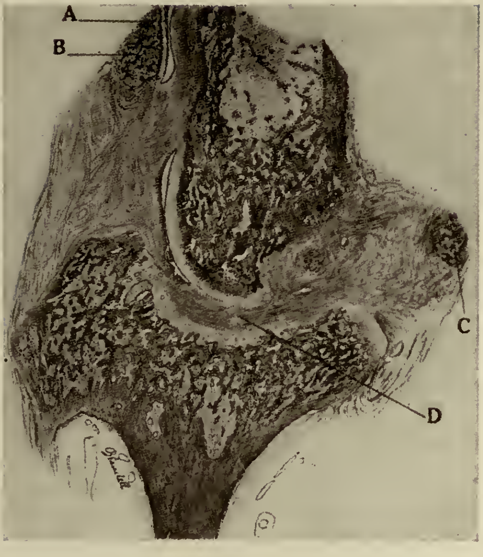

Fig. 286.—*B*, Patella; *C*, sesamoid bone; *D*, fibrous tissue ingrowth, with cartilage above and below.

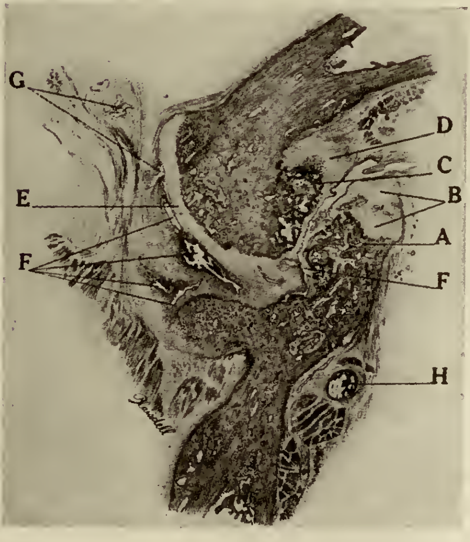

Fig. 287.—*A*, Spur on tibia; *B*, cartilage capping the spur; *C*, new bone in femur; *D*, cartilage capping the bone; *E*, new articular cartilage; *F*, slits or clefts in fibrous tissue (bursal cavities); *G*, synovial cavities.

which appear to be an early stage in the formation of a joint cavity.

Dog 17, Series 1 (Fig. 287). Removal of 22 mm. from the femur (a large amount for a dog of this size, almost reaching the medullary canal) and 7 mm. from the tibia.

Immobilization for about twelve days. After three hundred and forty-seven days microscopic examination of specimens shows the convex end of the femur is received into a concavity of the tibia. The concavity is formed by growth of bone anteriorly and posteriorly, there being more bone developed here than is required to bridge the gap between femur and tibia.

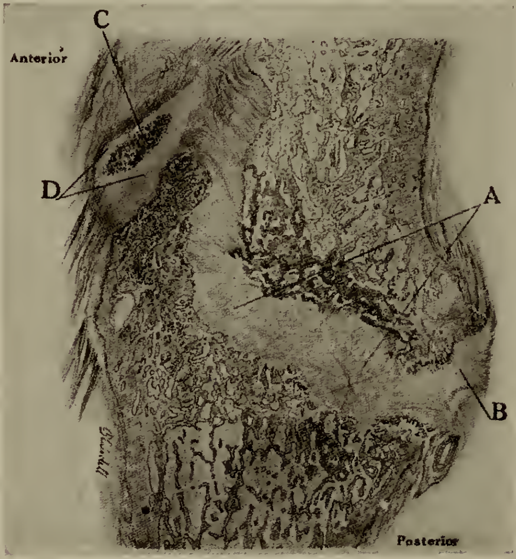

Fig. 288.—*A*, Dense fibrous tissue extending from femur to tibia; *B*, area of fibrocartilage; *C*, bone; *D*, cartilage.

The trabeculæ of the bone ends are considerably thickened, a bone buttress has formed, and the apposing surfaces are covered with new articular cartilage. At the periphery the bones are united by fibrous tissue, and large clefts lined by villous and irregular cartilage are seen. In this specimen a new joint has been formed, with new cartilage and synovial membrane.

Dog 16, Series 1 (Fig. 288). Removal of 20 mm. from femur and 17 mm. from the tibia. Immobilization fifty-six days. After ninety-seven days microscopic examination of specimens shows the bones bound tightly together by dense fibrous tissue containing a few scattered cartilage cells. There is no suggestion of a joint cavity.

Anteriorly and posteriorly there are islands of fibrocartilage which are undergoing ossification at their union with the bones. Anteriorly a long spur has developed from the tibia which extends upward in front of the femur.

This irregularity of the bone surfaces, together with the dense fibrous tissue binding the bones together, makes the union quite firm. Microscopic examination of the fibrous tissue shows it to be dense and avascular and that its bundles of collagen fibers extend for the most part from femur to tibia and are firmly united to the bones—anteriorly and posteriorly some of the fibers run for a short distance parallel to the sawn surfaces.

The bone trabeculæ at the ends of each bone are quite abundant, and a bone buttress has formed over the larger extent of the surfaces, closing off the marrow spaces.

In small areas the marrow spaces are still open. The marrow in the immediate vicinity of the sawn surfaces is fibrous and edematous; elsewhere it is lymphoid. While the reparative process in this specimen has probably not ended, judging from the fibrous marrow and open marrow spaces, it seems likely from the character of the uniting fibrous tissue and the extent of the new bone buttress that bony union will not be the final result.

Dog 20, Series 1 (Fig. 289). Removal of 5 mm. from the femur and 4 mm. from the tibia. Immobilization not stated, but as plaster-of-Paris spicas were applied in all cases immobilization was at least attempted.

After three hundred and four days microscopic examination shows bones bound together by fibrous tissue, the central fibers of which run largely in a direction parallel to the bones. Anteriorly some of the fibers are directed at right angles to the latter. Clefts appear in the fibrous tissue, the walls of which are quite irregular, and the tissue lining them stains poorly. A bone buttress has formed separating the marrow spaces from a layer of cartilage capping the bone ends.

In this series all excisions were done by the plane mode, varying amounts of bone were removed, and immobilization carried out for varying periods.

No special attempt was made to bring the sawn surfaces of the bones into close apposition, therefore all specimens showed varying degrees of separation of the bone ends.

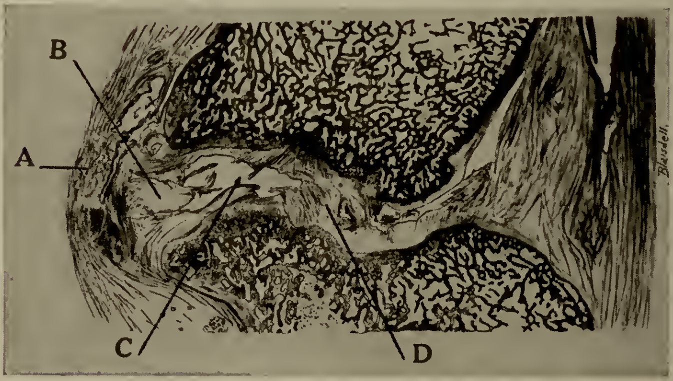

Fig. 289.—*A*, Periosteum continuous from femur to tibia; *B*, fibrous tissue ingrowth; *C*, cavity with irregular walls of necrotic fibrous tissue; *D*, uniting fibrous tissue, the bundles of which run parallel to long axis of bones.

In all specimens except two union is fibrous, and in these two it is fibrous for at least two-thirds the extent of the sawn surfaces. (See Fig. 285, Dog 8.)

Separation of bone ends and fibrous union must be intimately related.

In the second series, therefore, we fixed the sawn surfaces together in the following ways:

In 2 cases we excised the joint by the concavoconvex method. With the leg in acute flexion the posterior ligament and capsule were shortened by mattress-sutures; the leg was now extended and capsule and fascial structures sutured clear around, thus bringing the sawn surfaces in close apposition.

The patellar tendon was overlapped and sutured. In 2 cases the joint was excised by the plane mode and the bones brought together in the same manner. In one the bones were held together firmly by silver wire placed through epiphyses, ¾ inch from the sawn surfaces, and fixed tightly. In one fixation was made in like manner, using a strong silk suture.

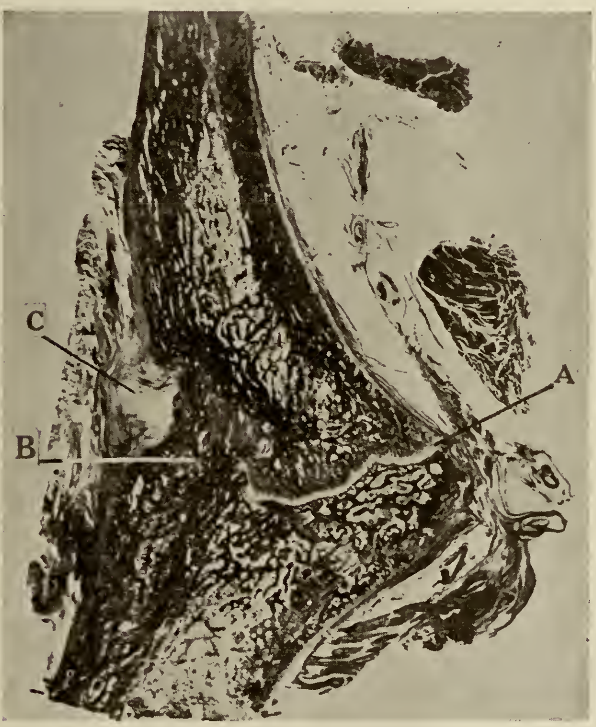

Fig. 290.—*A*, Epihyseal line; *B*, bone trabeculæ; *C*, small area of cartilage undergoing ossification. Healing by osseous union except in small area; *C*, note periosteum continuous over line of union.

In all 6 excisions bony union occurred between the entire extent of the sawn surfaces.

Dog 1, Series 2 (Fig. 290). Excision of joint by concavoconvex method removing cartilage and underlying bone buttress. Bones placed in apposition and held by silver wire. Immobilization twenty-four days. After sixty-seven days bones are firmly united by bony union over practically the entire extent of the sawn surfaces. Anteriorly and posteriorly the periosteum is continuous from femur to tibia.

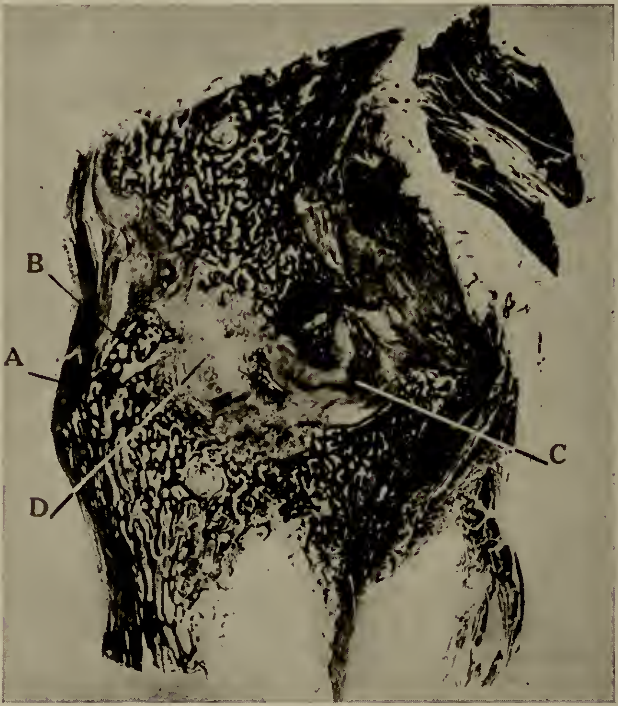

Fig. 291.—*A*, Periosteum continuous from femur to tibia; *B*, bone trabeculæ uniting bone; *C*, cartilage undergoing ossification; *D*, same at earlier stage.

Anteriorly beneath the periosteum at the level of the union of the bones there is a small area of cartilage undergoing ossification. Elsewhere bone trabeculæ of the femur and tibia are continuous. A portion of the epiphyseal cartilage of the femur remains. The marrow is lymphoid. Nowhere do we find any interposed fibrous tissue.

Dog 3, Series 2 (Fig. 291). Concavoconvex excision. Bones united by silk sutures inserted in similar manner to Dog 1. After sixty days bones were firmly united. Anteriorly and posteriorly the periosteum is continuous from femur to tibia. Beneath the periosteum the bone trabeculæ are continuous from femur to tibia, elsewhere the bones are united by fibrocartilage which is being invaded by blood-vessels from the bones. Numerous osteoblasts are present about the blood-vessels and osteoid material is being deposited. The marrow is fibrous. After sixty days we find no dense fibrous tissue between the bones.

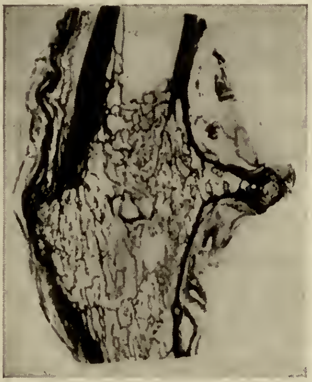

Fig. 292.—Showing complete bony union between femur and tibia. Note periosteum, cortical and medulla portions of bones continuous.

Dog 32, Ely (Fig. 292), illustrates the end-result in cases in which close apposition is secured by suture of the capsule. There is complete osseous union of the entire apposing surfaces and a medullary canal has been established through the line of union.

From the study of these specimens the reparative process following excision of the knee-joint may be summarized as follows: Hemorrhage from the vessels of the marrow spaces. The blood fills the space between the bones and extravasates for varying distances into the marrow of each bone.

The blood coagulates and fibrin is deposited on the sawn surfaces; this seals the marrow spaces and the vessels of the latter. The fibroblasts of the marrow proliferate, converting lymphoid into fibrous marrow; this is accompanied or even preceded by proliferation of endothelium in the form of capillary buds, arising from the capillaries of the marrow spaces, the two forming a delicate, edematous, highly vascular granulation tissue. The clot is invaded, and finally replaced by this granulation tissue.

With close apposition of the bones and with just sufficient clot to fill the space the conditions of repair are most favorable; if separation is present and the clot greater in amount, the task of the reparative process is magnified.

In cases where the bones are closely and firmly apposed over their entire extent, the new formed capillaries from the vessels of the marrow coalesce and finally bridge the intervening space, thereby establishing vascular communication between the two bones.

Osteal fibroblasts from the marrow spaces proliferate about the capillaries and these osteogenetic cells deposit their fibrils, cartilage, and osteoid material, which later is converted into bone trabeculæ, uniting femur to tibia.

In the immediate vicinity of the sawn surfaces there is a varying amount of necrosis of bone, as is indicated by vacant lacunæ and the staining reaction of the trabeculæ.

This necrotic bone is gradually rarefied by cellular and vascular erosion and the necrotic trabeculæ gradually absorbed.

When homogeneity between ossifying callus and rarefying bone has been attained the new trabeculæ which lie in the lines of greatest stress or pressure become more and more dense by a filling up of the vascular spaces with bone, while those which lie outside the lines of pressure are gradually absorbed until the medullary portion of the femur becomes continuous with that of the tibia, as is seen in specimen from Dog 32 (Fig. 292).

This is also observed in roentgenograms taken several years after knee-joint excisions in the human.

Successful union, therefore, presupposes the establishment of vascular communication between the bone ends. When contact leaves no room for any appreciable clot or, what amounts to the same thing, the more accurate the apposition the more infinitesimal the clot, the more certain is the healing by osseous union.

In all cases where special means were employed to keep the bones in close apposition bony union occurred rapidly, and the extent of this union was in direct proportion to the extent of contact of the sawn surfaces.

It is to be noted that in cases of joint excision there is nothing comparable to the periosteal bridge uniting fragments of a fracture.

Leaving out of consideration the osteogenetic power of the periosteum this tissue serves two very important functions in the healing of fractures: (1) the periosteal bridge prevents wide separation of fragments, and (2) it serves to confine the blood from the lacerated vessels extending from periosteum to the haversian canals of the cortical bone which coagulates and is organized by granulations developing from the vessels of the haversian canals and marrow spaces.

Subperiosteal callus is an important one in the healing of fractures and frequently exceeds in rapidity of development and in amount that formed from the marrow.

Repair after knee-joint excision is, therefore, dependent upon the medullary callus, and this is, as a rule, rather slow in its development.

If the bones are not maintained in close apposition, but are separated by gravity, as in cases of our first series, the clot between the bones is greater in amount and there is an additional factor in the reparative process tending to delay or even completely stop osseous healing. This is the ingrowth of granulation tissue from the periosteum. This hardier connective tissue reacts to injury by proliferation, invades and organizes the clot between the bones with greater rapidity than the more tardy granulations developing from the vessels of the marrow spaces. It forms a limiting membrane which prevents the fusion of the vessels of the medullary calluses.

The two types of granulations are easily distinguishable microscopically: That springing from the marrow spaces is delicate, highly vascular, and edematous, with few collagen fibrils; while that growing in from the periosteum is dense, less vascular, and shows bundles of collagen fibrils directed for the most part parallel to the sawn surfaces.

At times the rate of the growth of these two granulation masses appears to be about equal, so that a combination or intertwining of the two can be made out. In these cases the central fibers run for the most part parallel to the bones, while those at the periphery are directed at right angles to the latter.

The final result of the reparative process will depend upon which of these two masses of granulation gets the upper hand. As has been said, osteal fibroblasts proliferate along the capillaries of the granulations. The tissue formed by proliferation of the dense fibrous tissue of the periosteum is similar in all respects to the tissue from which it springs. It is dense and relatively avascular and seems to choke the more delicate and vascular granulations from the marrow spaces and prevent their fusion in a manner analogous to that which occurs in a so-called amputation neuroma, in which we see the axis-cylinders of the proximal segment of the injured nerve twisted and compressed in every direction. There appears to be sufficient growth of axons in the neuroma to bridge the defect, but they cannot get across.

Likewise there seems to be no failure in osteogenesis in most of the specimens which have failed to unite by bony union, for long spurs of bone, more than sufficient to bridge the space, are often seen extending from one or both bones.

The ingrowth of dense fibrous tissue from the periosteum has acted as a limiting membrane to prevent fusion of medullary granulations. It serves its purpose as efficiently as an interposed fat-fascial flap and ultimately has the same fate.

With the mobilization of the limb (removal of the spica) and its restoration to function, particularly weight bearing, the uniting fibrous tissue is compressed. In addition to compression there are sliding movements between the bones, especially in the anteroposterior direction. These movements produce separation of the collagen bundles; fibers are ground and torn and irregular slits or clefts with ragged walls appear. Continued compression with motion causes necrosis of these fibers, as is shown by their structureless appearance and staining reaction, and they are gradually absorbed or remain in the clefts as débris.

Coincidentally with the disappearance of the dense fibrous tissue, the medullary calluses of femur and tibia are undergoing changes.

Where these are subjected to pressure and motion they are transformed into cartilage; where irregularities in the apposing surfaces are present, so that depressions occur in which the tissue is not subjected to pressure, we often find a tissue resembling synovial membrane. This is seen, also, in other portions of the new joint where motion has existed without pressure.

There is still another way in which function seems to play an important part in the variation in end-result of the reparative process, and this occurs in the cases of firm fibrous union.

In these the fibers uniting the bones run for the most part parallel to the bones. A bone buttress separates the marrow spaces from the fibrous tissue; the bone ends are more or less serrated and the uniting dense avascular fibrous tissue bundles merge into these teeth of bone. There is no cartilage formation over the bone ends save in small areas where the healing process is still incomplete, and here the cartilage is being replaced by bone.

We assume that in these cases the granulations from the marrow and periosteum have fused; that with the mobilization of the limb weight bearing has not been resumed (the animal favors the limb because of tenderness or instability).

The weight of the leg produces tension on these granulations, and the fibroblasts respond to this by the development of an abundance of callogen fibers, the cells and fibers being arranged in the lines of tension.

We see this in cases of fracture of the patella and fracture of the olecranon process in which the fragments have been placed in apposition by wire or nail, but which are separated gradually by muscle pull.

We have observed the same arrangement of the uniting fibers in case of fibrous union following fracture of the midportion of the humerus. Here the weight of the lower portion of the arm and forearm has gradually separated the fragments.

The effect of tension on developing granulation tissue is easily demonstrated experimentally in case of fracture of the patella. Here we have a sesamoid bone developed in the tendon of the quadriceps extensor cruris muscle, which normally is subjected to pressure, but to a greater extent also to tension.

None of the ordinary methods used in holding the fragments together are sufficient to prevent separation by the pull of the quadriceps muscle in animals.

Its anterior surface is covered by a thick fibroperiosteum, while its posterior surface is covered by articular cartilage.

If we drill a hole in the center of the articular surface through half the thickness of the bone, this rapidly becomes filled with new bone and cartilage; if the hole is drilled in a similar position and extent through the fibroperiosteal surface we find that the fibrous tissue frequently grows inward, plugging the hole and preventing the outgrowth of the more tardy developing calluses from the marrow spaces, so that as an end-result there is an osseous defect at the site of the drill hole.

In this defect the cells and fibers run parallel to the long axis of the drill hole or at right angles to those of the fibroperiosteum, there having been no tension exerted on these ingrowing fibers.

If we saw the bone transversely and bring the sawn surfaces together by purse-string sutures of silk or wire and, in addition, suture the fibroperiosteum, we find it impossible to prevent separation by pull of the quadriceps extensor crucis muscle unless we sever the quadriceps or patellar tendon.

The steady pull of the muscle gradually separates the fragments, the sutures hold for a short time only. The end-result is a firm band of dense fibrous tissue, tendon-like in structure, binding the fragments together.

The cells and collagen fibers of the band are arranged in the lines of tension. If, however, we saw the bone longitudinally and suture the fibroperiosteum, the pull of the vasti inserted into the lateral aponeurotic expansions tends to separate the fragments anteriorly. As the patella rests in the intercondylar groove separation of the fragments anteriorly will tend to bring them together posteriorly.

Repair by bone posteriorly is the rule; repair by fibrous tissue anteriorly is frequently seen. Where this occurs the most superficial fibers run transversely to the direction of the fracture line that is in the line of tension.

From the foregoing experiments we find that osseous repair after excision of the knee-joint is dependent wholly upon the medullary calluses, which are slow in developing; that the conditions necessary for such union are: (1) that there shall be an early fusion of the medullary calluses with establishment of vascular communication between the femur and tibia, and (2) that the granulation tissue shall not be subjected to tension. (After fusion of the granulations and development of calluses pressure seems to have the opposite effect of stimulating bony union.) To secure these conditions a uniform contacting of the entire sawn surfaces of the bones and the maintenance of close apposition by suture of the capsule and ligaments are essential.

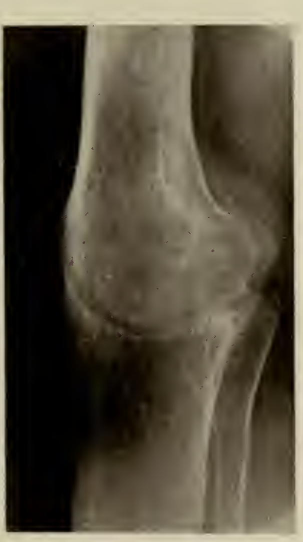

Fig. 293.—Excision by concavoconvex method for tuberculous arthritis showing complete union between femur and tibia.

Comparing the results of experimental excisions in cases in which bony union occurred with the results of excision of the human knee-joint as interpreted by roentgenograms, we find that where the bones were maintained in close apposition bony union occurred between the entire extent of the apposed surfaces. (Compare Figs. 290 and 292 with Fig. 293.)

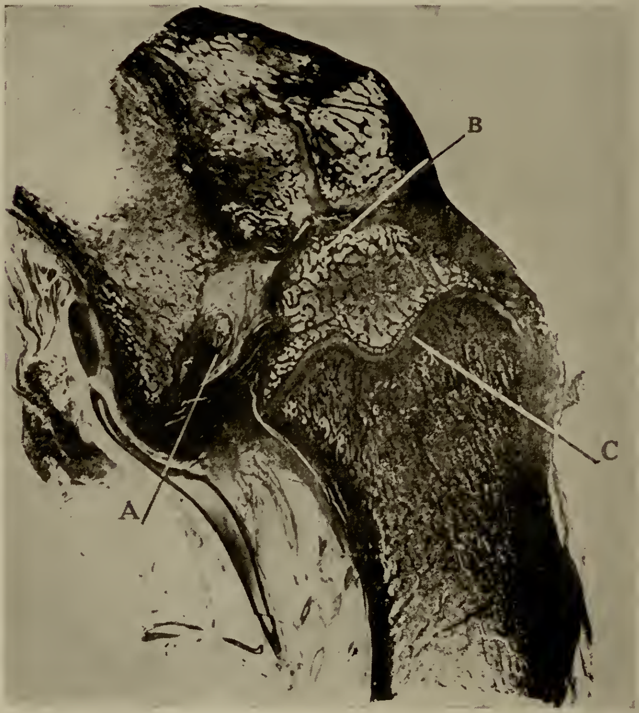

Fig. 294.—*A*, Area of ingrowth of dense avascular fibrous tissue, the bundles of which run parallel to the sawn surfaces of the bones. Internal to this is a smaller lighter stained area of cartilage undergoing ossification from its upper or femoral side. Above this the marrow spaces are open, elsewhere a bone buttress separates marrow spaces from fibrous tissue. *B*, Osseous union; *C*, epiphyseal cartilage.

On the other hand, where close apposition was maintained between a portion of the sawn surfaces only, with separation of the remaining portion, we find bony union in the former area and fibrous union in the latter. (Compare Fig. 294 and Fig. 295.)

In the portion united by fibrous tissue a new bone buttress is formed which separates the marrow spaces from the uniting fibrous tissue (Fig. 294).

Comparing the classic square or plane mode of knee-joint excision with the concavoconvex method we note the following:

Plane mode: While it is easier to remove the bone ends by this method, it is often difficult to saw them in the proper horizontal plane, so as to get a uniform contacting surface with the leg in proper weight-bearing relation to the thigh.

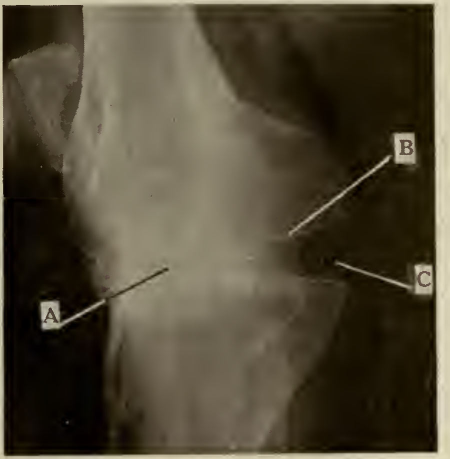

Fig. 295.—Excision by plane mode: *A*, Bony union; *C*, fibrous union; *B*, bone buttress separating marrow spaces from fibrous tissue.

If this is not accomplished and the sawn surfaces are brought in close apposition a valgus or varus malposition occurs. (A few degrees of flexion gives a slightly better cosmetic as well as functional result than that produced by an absolutely straight limb.)

If the leg and thigh are now placed in the position most suitable for weight bearing, there will be a triangular gap with base directed anteriorly, posteriorly, laterally, or mesially (Fig. 295).

As the sawn surfaces of the bones are not equal in extent they tend to slip past each other. To prevent this, nails have been used. With this method more bone is sacrificed than is necessary.

Concavoconvex method: This method requires a little more care in the sawing of the bones, but it gives a uniform contacting of the entire bony surfaces, regardless of slight degree of flexion or extension of the leg or the thigh (Fig. 293).

The sawn ends of the bones are prevented from slipping past each other and a minimal amount of bone is sacrificed.

Operation.—Several incisions have been used to obtain access to the articular surfaces of the knee-joint, each having some special object in view.

The lateral incisions, internal (v. Langenbeck's), and the external (Kocher's) aim to preserve the extensor apparatus, but as they do not permit of easy access to all portions of the joint, they are limited to cases of partial excision, in which a movable joint is anticipated.

The transverse incision (Volkmann's) across the joint, over the middle of the patella, followed by division of the bone, gives excellent exposure of the joint structures, but this incision and the upper curved incision (Hahn's) possess no real advantage over the lower curved incision (Textor's) which we use.

Where bony union is sought it is not only immaterial whether or not the patella is divided, but in most cases it is well to remove it.

With the knee flexed and the sole of the foot resting on the table, a curved incision is made extending from the posterior part of one tuberosity of the femur to the corresponding point on the opposite tuberosity, the lower and midportion of the incision crossing the ligamentum patellæ at about its center.

The incision is carried down through the ligamentum patellæ and capsular ligaments through its entire extent, and the patella is raised in a large U-shaped flap.

Bleeding points are caught and ligated. The tense crucial ligaments now come into view; these are cut across close to the condyles.

The femur and tibia are now easily separated and the posterior portion of the joint readily examined.

The lower end of the femur can now be projected through the wound.

The patella is excised or its posterior or articular surface is sawn off.

Removal of the synovial membrane is done by knife dissection, supplemented by scissors curved on the flat. The infrapatellar pad of fat with synovial membrane covering its upper surface is first removed; dissection is carried upward and the synovia covering the deep surface of the quadriceps on either side of and above the patella including the anterior wall of the subcrural bursa to the upper limit of the bursa is removed.

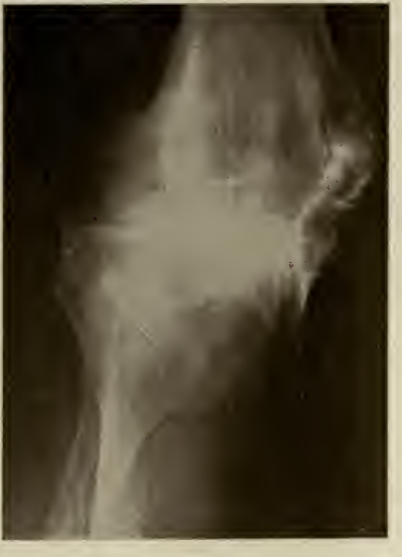

Fig. 296.—Excision by plane mode for chronic arthritis, non-tuberculous showing bony union over practically entire extent of sawn surfaces.

The synovia of the posterior wall of the bursa with the subsynovial fat is now dissected off the supratrochlear portion of the femur, and that covering the lateral aspects of the condyle, which is more closely adherent to the bone, as well as its reflection on to capsule is removed.

The head of the tibia is drawn forward, the remnants of the crucial ligaments and the semilunar cartilages are cut away, thus clearing the intercondylar notch.

The lower end of the femur is now protruded through the wound; the structures of the popliteal space are protected by a spatula and the cartilage and bone buttress removed with a bow saw, the edge of which is turned toward the bow. The saw blade is introduced posteriorly and is kept in a plane exactly parallel to the under surface of the condyles.

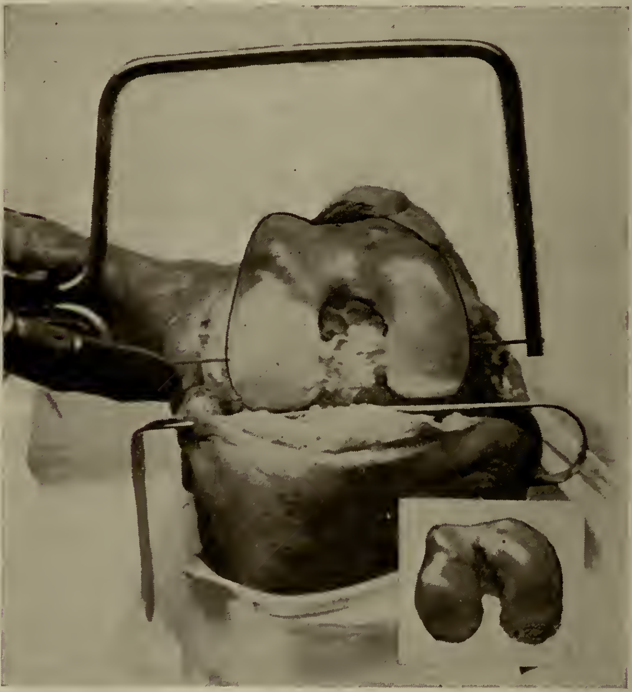

Fig. 297.—Showing method of sawing femur. The edge of the saw is directed toward the bow; the blade is introduced posteriorly and is kept in a plane exactly parallel to the under surface of the condyles. Insert: Cartilage and bone buttress removed.

Note.—The shaft of the femur does not occupy the axis of the thigh, but inclines inward from hip to knee. Because of this the internal condyle is of greater length than the external condyle, and the lower surfaces of the condyles lie in the same horizontal plane when the patient stands erect.

It follows, therefore, that the femur must be sawn in a plane parallel to the undersurfaces of the condyles. If this is not done, too much bone is apt to be removed from the internal condyle so that when the bones are brought into apposition there is an inclination of the tibia inward.

To correct this more bone must be sacrificed.

The head of the tibia is now drawn forward and sawed across in a concave manner from front to back, there being no danger to the structures in the popliteal space, as they lie some distance from the posterior margin of the articular surface.

The two sawn surfaces are examined and any remaining foci of disease are removed with a curet.

If the bone section has been made accurately the sawn surfaces fit exactly.

The remaining synovial membrane in the posterior portion of the joint, including that which lines the pouches behind the remains of the condyles, is removed.

Oozing is arrested by pressure with gauze wrung out in hot saline.

It is essential that all bleeding shall have stopped before closure of the wound.

With the bones in the acutely flexed position the posterior ligament is shortened by four mattress-sutures of kangaroo tendon. The leg is now extended and the wound is closed by suture of the capsule and ligaments, with overlapping of the patella tendon. The skin and subcutaneous tissue are sutured and the wound dressed with gauze.

A circular plaster-of-Paris dressing is applied from groin to foot and a fenestrum made over the incision.

This is replaced after six weeks by a brace, and the patient encouraged to bear weight. The brace is worn until union is solid.

We do not use the Esmarch bandage during operation because of the increased oozing which follows its removal.

In excision for arthrodesis, especially in the young, care must be exercised not to injure the epiphyseal cartilage. In these cases the cartilage and bone buttress may be removed by chisel. Hibb's operation for stiffening the knee-joint is preferable to excision in these cases.

In excision for ankylosis in deformity care must be taken not to wound the structures in the popliteal space either when dividing the bones or when correcting the deformity. To protect the structures in the popliteal space the soft parts are separated around the lateral margins of the tibia and a narrow spatula inserted. The bone is sawn to a position near the posterior limit of ankylosis, and by flexion the remaining bone is fractured.

The bone ends are now treated as described above. Sufficient bone must be removed to permit straightening without undue tension of the structures of the popliteal space.

Especial acknowledgment is made to Dr. Frank E. Blaisdell for his work in preparing the photographs for this article.

CLINIC OF DR. JOHN HOMER WOOLSEY

University of California Hospital

GASTROJEJUNAL AND JEJUNAL ULCER: CAUSE, DIAGNOSIS, TREATMENT

Case I.—J. A. is a Portuguese ranchman thirty-eight years of age, and enters the hospital complaining of abdominal pain on lifting or accompanying heavy work. He was operated upon nine months ago by another surgeon, who writes as follows: "I made an exploratory incision, performed a gastro-enterostomy, posterior, no loop appendectomy. There was no carcinoma, but evidence of ulcer of pylorus."

Present Illness.—His family and past history are of no importance. Previous to his original laparotomy the patient's complaint was pain in the epigastrium after meals, frequently accompanied by vomiting. There was a gradual increase in severity of all symptoms until he was unable to take solid food. Subsequent to the initial gastro-enterostomy the patient was comfortable for a period of approximately six months. He states that his recovery from the operation took five to six weeks and that a drainage-tube was left in the wound for two weeks.

Three months ago, while lifting an object, he felt a sharp, non-radiating pain in the region of the incision, which persisted to such a degree that he remained in bed for two to three days. He has had this same pain return with any exertion, so that he has discontinued his work. A letter from a local Social Service worker states: "The patient has not worked since the last operation." He has never noted any relation to meals or relief by any measure except rest. Two weeks ago he had a diarrhea for two or three days, and he reports that his stools contained blood.

Physical Examination.—A well-developed and nourished male, ambulatory, not ill looking, speaks and understands English with considerable difficulty, and does not observe keenly. The essential findings are the poor hygiene of the teeth, with pyorrhea of a severe degree; enlarged, non-tender operative upper right rectus scar, 3 cm. broad at the center and apparently attached to some underlying structures, as noted by its depression with respiration; no point of abdominal tenderness, and liver edge, spleen, and kidneys not palpable.

Laboratory.—The urine showed a faint possible trace of albumin, but was otherwise negative.

The blood-picture is: Hgb. 90 per cent.; red blood-cells, 5,620,000; white blood-cells, 7200; differential: Polys., 63 per cent.; S. M., 29 per cent.; L. M. and T., 5 per cent.; E., 3 per cent.

The stool examination, with a controlled diet, shows, on repeated occasions, no fresh or occult blood present.

The gastric functional test-meal shows a benzidene test faintly positive, all specimens tinged with bile except the first and second, a total acid from 15 to 38, and free HCl 5–18.

The blood Wassermann is negative.

x-Ray.—Fluoroscope examination is as follows: "The lung fields clear. Right diaphragm rather flattened. Heart and arch O. K. Esophagus negative. Stomach good position, no peristalsis seen, empties rapidly through gastro-enterostomy. There is a slight barium residue in the first loop of small intestine clinging to walls, possibly due to ulceration. There is a small amount of emptying through pylorus. The antrum just inside pylorus shows a fairly large defect. Conclusion: Functioning gastro-enterostomy—question ulcer in jejunum. Lesion in antrum."

Discussion.—The history of abdominal pain in the region of the operative scar, occurring with any muscular effort and relieved by rest, suggests some mechanical cause resulting from the former operation. This might be from intraperitoneal adhesions of some viscera to the operative wound, but unless some other complication, as a local hemorrhage, partial strangulation of the bowel, volvulus or some condition equally severe, has ensued, it would not with any probability have remained for two to three days steadily, and would not have prevented the average man from performing some work during the past three months. There is no sign of a hernia in the operative wound or in the actual openings from the peritoneal cavity. Tension on the omentum in an inguinal or femoral hernia will often be referred to the epigastric region entirely.

The fluoroscopic examination has revealed the possibility of a jejunal ulcer, but there is no clinical data to substantiate this except the knowledge of a previous gastro-enterostomy.

The patient interprets his symptoms poorly and carelessly—always in relation to work. He claims to be industrious and has a large family to support. Since he suffers so severely as to prevent his return to work it seems justifiable to recommend an exploratory laparotomy.

The preoperative diagnosis of intraperitoneal adhesions is decidedly unsatisfactory, but the clinical history which is so important in such a postoperative course as this does not suggest any gastric or intestinal participation.

Operation.—An upper right rectus incision, 15 cm. long, is made medial to the former incision and developed through to the peritoneal cavity. Well-developed adhesions are present between the transverse mesocolon and the former operative scar, but are easily separated without need of hemostasis. A few fine adhesions between the gall-bladder and liver and the duodenum are separated. A soft scar is seen just to the duodenal side of the pylorus, but there is no thickening of the wall, no enlarged lymph-glands, and no signs of an old ulcer on the gastric wall. The pylorus has the normal patency. The exposure of the gastro-enterostomy site beneath the transverse mesocolon is effected with difficulty, as you see, from adhesions. These are abnormal and suggest active pathology. The entire gastro-enterostomy stoma margin is thickened, especially at this point, where there is an indurated area 1 cm. in diameter with a crater-like center. The jejunum itself is normal. This is a so-called marginal ulcer and the induration throughout the gastrojejunal junction suggests some irritating object that has affected the entire circumference of the stoma.

It has been found by experience that no local plastic measure is of avail. Excision of the gastro-enterostomy and restoration of the original tract is the only effective treatment. The transverse mesocolon is, therefore, separated from its attachments to the stomach wall, watching closely that the middle colic artery, which you see lies just to the right of the gastrojejunostomy, is not injured. Now that the stomach is entirely free it is opened, holding up the walls with Allis' forceps as we proceed. The large blood-vessels in the gastric wall are ligated with black silk No. B (these will be completely turned in with the closure) as a prophylactic measure against postoperative hemorrhage. The stomach is now closed with two layers of chromic catgut No. 2, and the opening in the transverse mesocolon closed and sutured over the closure of the former gastric stoma. You

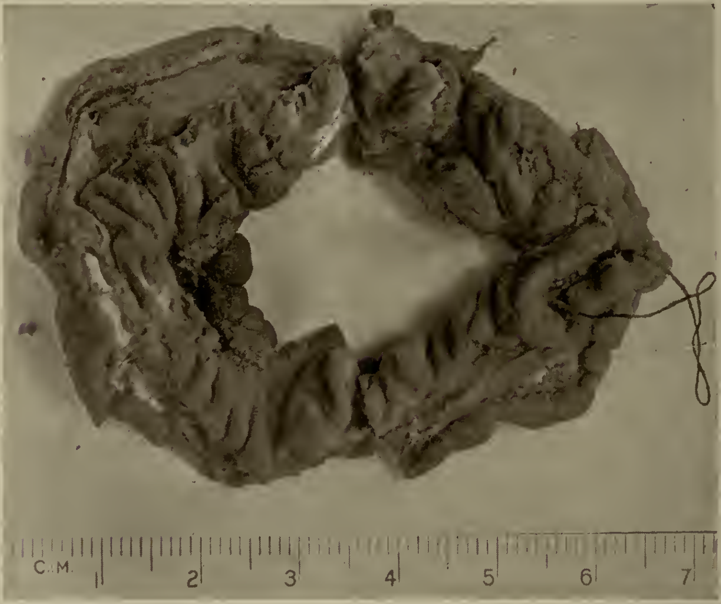

Fig. 298.—Gastro-enterostomy stoma showing attached linen suture and a gastrojejunal ulcer.

observe that the excision of the jejunum is close to the gastrojejunal margin. This is done with the desire to preserve as much of the circumference as possible for a plastic closure. No ligation of vessels in the jejunal wall is necessary. The two antimesenteric borders of the jejunum are approximated and the closure is made with two layers of chromic catgut No. 1, employed in the form of continuous Lembert stitches respectively. Over the closure this tab of fat is attached with plain catgut No. 00 so as to prevent the occurrence of adhesions. This concludes the operation except for the closure of the abdominal wall.

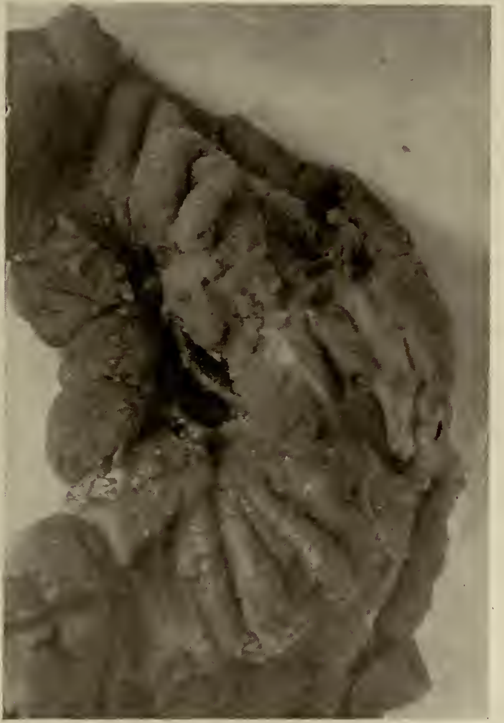

Fig. 299.—Gastrojejunal ulcer with strand of black linen across its base.

Pathology.—The specimen (Fig. 298) is most interesting, for it illustrates what many surgeons claim does not occur. You observe this loop of black linen suture which had dangled in the jejunum where food could catch in it. The fluoroscopic picture of "barium residue in the first loop of the small intestine clinging to the walls" was due, undoubtedly, to the barium adhering to this suture. You observe that the entire circumference of the stoma is raised and approximately 0.5 cm. thick, whereas it should be as soft and pliable as the ordinary gastric wall. At the opposite side you see, on the gastric side, a crater effect 0.5 cm. in diameter, and, if you look closely (Fig. 299), you see, running across its base, a portion of the black linen suture. This is an ulcer of some duration. It has a hard indurated border and a fresh eroded appearance at its base, signifying activity. In the cross-section (Fig. 300) at two points of the specimen you observe the suture is apparently the external or deeper suture. The conclusion is obvious, then, that this is a marginal gastrojejunal or so-called marginal ulcer due primarily to a non-absorbable suture.

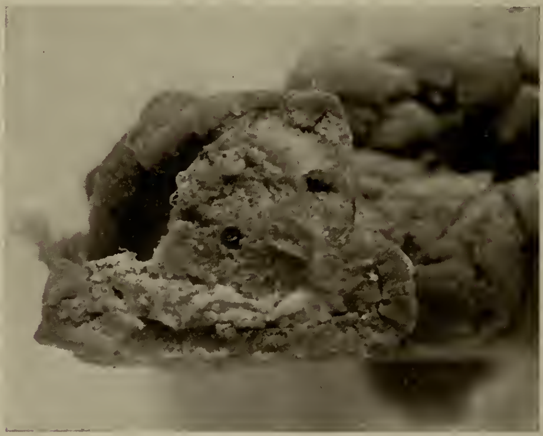

Fig. 300.—Cross-section of the edge of the gastrojejunal stoma showing the black linen suture as the outer stitch.

Subsequent History.—This patient returned to his usual work three months after operation. Six months after operation he reports that he is now enjoying the best of health, eats the same food as the remainder of the family, and considers himself cured.

Case II.—The second patient, L. A., an Italian male, aged thirty-five years, employed in a clerical capacity, entered the hospital on a stretcher, complaining of severe abdominal pain and vomiting. His family and past history are unimportant.

Present Illness.—At twenty-one he observed for the first time abdominal symptoms, characterized by constant pain, most marked shortly after eating, in the umbilical region. At twenty-five and a half he had attacks of vomiting three to four days in duration, fifteen to thirty minutes after meals, not associated with pain, and coming at intervals of several weeks. At twenty-six he had a sudden severe epigastric pain, followed by collapse, for which he was operated. A perforated gastric ulcer, 2 cm. from the pylorus, was closed. He had an uneventful recovery, but continued to have a burning, gnawing pain one to two hours after meals, relieved by food.

Four months after the emergency operation he was again operated by the same surgeon, who excised a scar-like area near the site of perforation and performed a posterior gastro-enterostomy. This was followed again by a burning epigastric pain two to three hours after meals, relieved by food.

Eight months later, due to moderate hematemesis and vomiting, he was again operated by another surgeon. The gastro-enterostomy stoma was found to be patent and soft. A scar in the region of the pylorus was observed and a pylorectomy was performed. Later examination of this excised tissue showed no pathology.

One month after operation he returned with the old complaint, accompanied by marked belching and early signs of gastric tetany. He improved under rest and dietary measures. He followed as far as possible at his boarding house a special diet which gave him partial relief from the abdominal pain and only rare vomiting.

Three years after the last operation he had hospital treatment for a severe hemorrhage by mouth and rectum. One year later there was a recurrence of the bleeding and the patient again entered. Rest and dietary measures were once more effective. For the following two years he had much gaseous distention, sour stomach in the morning, constipation at times, but no abdominal pain other than that associated with distention. No vomiting.

Yesterday at 9 P. M. he had a sudden attack of severe abdominal cramp-like pains across the upper abdomen and radiating to the right shoulder and interscapular region. They continued for one-half hour and then, by vomiting approximately 500 c.c. of bile-stained fluid, he secured temporary relief. The pain and vomiting recurred one hour later. It was so severe that at 11.15 P. M. he entered the hospital. At this time his temperature was 37.5° C., pulse 92, respiration 24. An examination of the abdomen showed marked rigidity, especially in the right upper quadrant, where it was board-like in character, accompanied by generalized marked tenderness to pressure. There is a small reducible ventral swelling 1.05 cm. in diameter in the midline, just above the umbilicus. Hot magnesium sulphate compresses were applied to the abdomen, with some relief, but the patient continued to have a constant non-radiating dull pain in the epigastrium and right upper quadrant, in addition to severe generalized cramp-like pains, recurring every hour and persisting from ten to fifteen minutes. He has a definite and constant point of tenderness 6 cm. to the left and slightly higher than the umbilicus. Rectal examination is negative.

Examination of the blood shows W. B. C., 11,300; polys., 79 per cent.; lymph., 11 per cent.; L. M., 10 per cent. The urine was entirely normal. The blood chemistry shows non-protein nitrogen 35 mg. per 100 c.c. Total urea 17 mg. per 100 c.c. An *x*-ray with barium shows "Barium remains inert in the stomach during five minutes' observation. No emptying and no peristalsis seen after twenty minutes. Lower end of the stomach constantly irregular, either from spasm or defect. Patient screened lying down only. Seemed to be in great pain at time of examination."

The patient is not toxic, but dehydrated, and he is suffering from severe abdominal pain and an inability to take fluids or food by mouth because of marked vomiting. He is a medium-sized active type of man with an excitable temperament. The teeth show some pyorrhea. Tonsils are enlarged and cryptic. His physical examination, other than that given, is negative.

Discussion.—The immediate symptoms point to a partial obstruction high up in the gastro-intestinal tract. This might be due to adhesions with a kinking of the small intestine or to a hernia with a partial constriction of the intestinal lumen. The former is often associated with an active inflammatory process, or else due to herniation of intestine under an old so-called "fiddle-string" adhesion. There is no hernia that can be observed through the abdominal parietes that can account for it. The past history is that of an active ulcer with bleeding. The original perforation with continuance of symptoms thereafter, then the recurrence after the gastro-enterostomy, the lack of relief after pylorectomy, the negative pathologic findings of the excised tissue, the lack of signs of ulceration on the lesser curvature, and the attacks of hematemesis suggest an ulcer. The location of tenderness to the left of the umbilicus, as pointed out by W. I. Terry, is perhaps peculiar to jejunal irritation. Bleeding as marked as above given from esophageal varices is possible, but not probable, and there are no concomitant signs that would go with this of any venous stasis, hepatic changes, or splenic pathology. The past history of gastric distress with the present history of a partial obstruction, aided by the *x*-ray findings, suggests a block in the jejunum which may possibly be due to a jejunal ulcer. Therefore the patient goes to operation with two diagnoses: (1) Partial intestinal obstruction in the jejunum, and (2) perforating jejunal ulcer.

Operation.—The incision is made so as to excise this wide epithelial scar of the former operation. As the peritoneal cavity is opened two important observations are made: well-formed adhesions and some free, thin, milky, odorless type of fluid. The former, a result of former operations, are divided close to the parietal peritoneum where the blood-supply is least. Exploration of the right upper quadrant shows a gall-bladder with slightly thickened opaque walls. It empties freely and is unaccompanied by any local lymph-gland enlargement. The foramen of Winslow, due to old inflammatory reaction in this region, is closed.

The stomach is normal in size and tone and the lesser curvature free from all sign of inflammatory reaction. As the transverse colon and omentum are raised you observe that the underlying intestines are injected, but not distended, and here and there are plaques of lymph. There is a large amount of the plastic exudate in the region of the gastro-enterostomy. Three centimeters below the gastro-enterostomy on the antimesenteric border of the jejunum is an indurated area 1.5 cm. in diameter, and associated with this a constriction of the intestinal lumen from the inflammatory cicatricial reaction. Over the center of the indurated area is a large plaque of lymph and under this is found a small hole through which bile-stained fluid now oozes. This is a perforated jejunal ulcer of considerable duration, and in addition to the usual symptoms it has given a partial obstruction of the intestinal lumen.

For reasons that will be discussed later it is found best to excise the gastro-enterostomy and its pathology and allow the course of the food to assume its normal route. Because of the former pylorectomy we have an additional difficulty, and therefore the possibility of a gastroduodenostomy must first be determined. By pulling the second portion of the duodenum markedly to the left the peritoneum laterad to it is exposed. This is now incised and by blunt dissection with the finger the duodenum is mobilized sufficiently to approach the midline by approximately 5 cm. over that of its original location. The distal end of the stomach is dissected free, and with a technic similar to that of the Finney pyloroplasty the end of the stomach is anastomosed to the side of the duodenum. Chromic catgut No. 2 is employed in two layers for the anastomosis. Three additional mattress-sutures of chromic catgut No. 1 are placed over the ventral side of this union; and then some local omental tissue is attached in such a manner as to cover the anastomosis. The gastrojejunostomy stoma, together with the portion of ulcer-bearing jejunum, is excised with the cautery, cutting across the jejunum on the distal loop, above the Payr crushing clamp and on the proximal loop below the Payr crushing clamp. The transverse mesocolon, attached at the former operation, is now separated from the stomach wall. By holding up the stomach wall with Allis' forceps, to prevent leakage of gastric content, the gastrojejunostomy stoma is cut free and removed. The stomach is now closed with two layers of chromic catgut No. 2 sutures, the inner layer according to the continuous Connell suture and the outer a continuous Lembert. The opening in the transverse colon is closed with interrupted plain catgut No. 1. The end of each jejunal stump is now closed over the Payr clamps by the right-angle Cushing suture. With the removal of the clamps the suture is pulled taut and automatically inverts the intestinal edges. A second suture of continuous Lembert reinforces the initial Cushing suture layer. A lateral anastomosis, while theoretically not so good, but practically more certain to function in the majority of instances, is now performed between the two portions of jejunum. Two layers of chromic catgut No. 1, in the usual method, are employed, and a few tabs of local fat attached to cover the line of anastomosis. The abdomen is then closed without drainage according to the method described by Searls.

Question.—What anesthesia are you employing?

That is a combination of nitrous oxid, oxygen, and ether. Ether has been administered only at the start and finish for purposes of relaxation. The nitrous oxid and oxygen all during the stomach and intestinal surgery has not irritated the respiratory tract and has not destroyed hemoglobin as ether does. You will also observe that coincidently with the operation a hypodermoclysis of 1000 c.c. Ringer's solution (because of the dehydration of the patient and the length of the operation) has been given in the thighs.

Pathology.—The specimen consists of the gastrojejunostomy stoma of a small portion of the proximal loop of the jejunum and approximately 6 cm. of the distal loop of jejunum. The edge of the stoma is as soft and normal as the gastric wall itself. At this point, approximately 3 cm. below the gastrojejunostomy stoma, is a perforation 0.25 cm. in diameter and about it is an indurated thickened jejunal wall extending for three-quarters the circumference of the intestine. Upon opening the intestinal lumen the indurated thickened area is seen to have a crater-like center 0.5 cm. in diameter, with absent mucosa and an indurated jejunal wall covered with edematous mucosa. The mesenteric side of the jejunal wall and its mucosal membrane are uninvolved. The remainder of the jejunum is normal. This is a jejunal ulcer secondary to gastrojejunostomy and has been present for some months at least. From the history of clinical symptoms, the negative findings at the third operation, and continuance of symptoms thereafter one would be justified in concluding that this jejunal ulcer has been present ever since the gastrojejunostomy nine years ago, and was the probable cause of all the symptoms. The patient's future course may or may not substantiate the conclusion, and so will be observed with special interest.

He was advised to follow a soft diet and to use alkalies for any burning pain. He was also advised that the teeth should be properly attended to and the tonsils removed.

Subsequent History.—The patient had his tonsils removed and his teeth properly repaired. He has had recurrent attacks of distention with gas, marked belching and, at one time, a three weeks' period of a burning epigastric pain, relieved by alkalies. By *x*-ray examination no six-hour residue has ever been observed and no definite signs of any ulceration. The patient has been working 50 per cent. of the time since his operation, and at present, one year later, enjoys the best health for the past ten years.

Diagnosis.—Gastrojejunal and jejunal ulcer are prone to occur subsequent to approximately 3 per cent. of gastrojejunostomies. The symptoms may start immediately after the patient is up and about from the operation, as they did apparently with patient No. 2, or they may start years later. As a rule, however, the first clinical symptoms are within four months from the operation. The recurrence of all the former symptoms, but not so periodic and not so severe, is the usual finding. A burning, gnawing pain occurring one to three hours p. c., relieved by food or alkalies and somewhat by rest and, as a rule, referred to a point left of the umbilicus, is most suggestive. With this the patient may have occasional vomiting, persisting for one to two days. Hemorrhage, with a negative history for this previous to operation, is strongly indicative of this type of ulcer. With such an ulcer fresh blood may be vomited, and occult blood will always be found in the stools.

Physical examination is of value in some instances. Many patients have tenderness across the entire epigastrium, but a point of tenderness emphasized by Terry, located 2 to 4 cm. to the left of the umbilicus, is more characteristic. A palpable tumor mass just to the left of the umbilicus is sometimes observed. Test-meals are, as a rule, of no advantage. Roentgen-ray examination is of value in a corroborative manner. Ruggles notes the Roentgen evidence of gastrojejunal ulcer as follows:

"1. Persistent irregularity in the region of the stoma.

"2. Constant spasm in the stomach wall opposite either margin of the stoma.

"3. Six-hour residue in the stomach or jejunal loop.

"4. Gastric hyperperistalsis.

"Of these, the most significant is the deformity of the outline of the margin of the stoma or proximal portion of the jejunum, which is constant in all positions of the patient and upon repeated examinations. Spasm in the stomach wall opposite the margins of the opening, when present, is a very great help in establishing the diagnosis. Unfortunately, these contractions are not always evident even when the extensive ulceration exists. They are usually seen when the gastric mucosa is involved. Jejunal ulceration alone causes localized spasm in the jejunum which is a factor in the production of the deformity noted above. Residue in the stomach or jejunum and hyperperistalsis are only indirect evidences, but when both are found ulceration is to be strongly suspected."

Etiology.—The cause of gastrojejunal and jejunal ulcer secondary to gastro-enterostomy is not definitely known. There are, however, two main theories, one that it is due to the acid gastric secretion pouring directly on the jejunal mucosa, the other, that certain mechanical trauma is the basis. As regards the former, it is interesting to note that but two primary jejunal ulcers have been reported, and they were syphilitic in one instance and probably so in the other. Only a few cases have ever been reported subsequent to gastrojejunostomy for cancer of the stomach. The majority have occurred by far following operation for gastric or duodenal ulcer and the greater proportion of these have been associated with instances of a wide open pylorus. The bolus of undigested food passing over the area, the acid medium, or the lack of the usual alkaline medium by which the pepsin may act directly on an injured jejunal mucosa are important factors according to many of the leading gastro-enterologists today. Mechanical trauma from pressure of the clamps so commonly used in gastro-enterostomy is considered evident, for in many instances the ulcer has occurred exactly where the clamp pressure was applied. Pressure necrosis with a resultant infarct is supposedly the result. It is possible that the jejunal ulcer of Case II is an example of this. Hematoma from the trauma of the needle with a lowered local resistance and infection added as a secondary factor is another probable cause. The non-absorbable suture is a known common cause, and yet many surgeons continue to employ it. One has only to read the literature to find that every one of experience is convinced of this. Gronnerud, reporting experimental work on 4500 animals, says: "The noteworthy frequency of peptic ulceration following the use of silk sutures and the almost total absence of this sequela after the catgut anastomosis convinced us that here was the etiology of this after-effect." It is of interest to note in the first patient that it was the outer suture that had caused an ulcer at one point and had penetrated into the intestinal lumen at another point.

Treatment.—The preventive treatment for jejunal ulcer subsequent to gastrojejunostomy is of first importance. Strict attention to the diet and the employment of alkalies for a proper period of time, dependent upon the condition found, are essential. The eradication of all foci of infection, especially those of the tonsils and teeth, are equally essential. Medical treatment after the ulcer has occurred is in the majority of instances palliative only.

Surgery is the choice. Any plastic on the gastrojejunostomy itself for a jejunal or gastrojejunal ulcer is of little or no value, for there is a high proportion of recurrences with such treatment. If such an ulcer occurs it is best to completely undo the gastrojejunostomy, excise the jejunal ulcer, and re-establish the normal circuit. The chromic or tanned gut suture with the type of needle in which the suture is indirectly fastened (swedged) in the needle is the best. Permanent suture material, as linen or silk, is unnecessary and should never be employed.

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CLINIC OF DR. ALANSON WEEKS

Surgical Department, University of California,
St. Luke's Hospital

LARGE INTRACAPSULAR HEMORRHAGE OF THE LIVER

This patient was referred to us from the medical side with the following important points in his history:

He is a cowboy by occupation and was in the American Army in France, and gives a history of having been gassed while in the Argonne battles, but not badly enough to necessitate sending him to a hospital. In November, 1918 he had a diarrhea for several weeks and lost about 25 pounds at that time. Since then he has had several attacks of diarrhea.

One month and a half ago he was riding in a rodeo in the state of Washington and while "bull dogging" a steer, as he threw himself from the back of his horse to seize the steer by the horns, his partner, who was riding behind to keep the steer on the run, was unable to stop his horse and ran into the patient and the steer. In the struggle the right horn of the steer was broken off and the horse's feet struck the patient in the back and right side, breaking 4 ribs in front just behind the right costal arch. In spite of all this the patient threw his steer and was able to get up and walk off the track into the center resting area. He thought at the time that his right arm was broken because of the pain in it. He sat down for about fifteen minutes and upon attempting to get up his "wind" was suddenly shut off and he could not walk, but "fell in a heap." After a second attempt to get up he was carried to a tent and laid down for about four or five hours and then taken to a hospital, where, he states, he was kept quiet under dope. He passed blood in his urine for two days and nights. He remained in the hospital for two weeks and two days, being up and down, and left the state of Washington for Los Angeles, California, in an automobile. On the way down he had "spells," and great pain in his right hip prevented him from walking or sitting. It was necessary to stop in a hotel for one week and rest.

Upon entering St. Luke's Hospital his blood count was 55 per cent. hemoglobin and 3,800,000 reds, 10,000 whites, with 76 per cent. polys. The blood-count today showed 16,800 polys. Urine examination upon entering the hospital was negative. Twenty-four-hour specimen two days after entering the hospital was negative except for a few red blood-cells. Examination of the urine yesterday showed considerable albumin with many red blood-cells.

The cystoscopic examination with catheterization of the ureters showed:

	Right.	Left.	Mixed.
Phthalein,	0	3.0 per cent.	
Urea,	0.2 per cent.	0.2 "	
Red blood-cells,	xxx	0	x
White blood-cells,	xx	0	Occasional.

A guinea-pig was inoculated subcutaneously with urine and was killed and autopsied. The findings were normal.

Blood Wassermann was negative.

x-Ray examination showed a small amount of fluid in the pleural cavity, some of which was aspirated and found negative.

It is perfectly evident from the appearance of this large man that he has lost considerable weight; that he is markedly anemic, and by the expression of his face that he is in distress.

Inspection of his abdomen shows it to be markedly protruding on the right side. Palpation shows a mass exactly the shape of a very large liver which practically fills the right side of the abdomen.

Our diagnosis of his original injury was rupture of the liver and right kidney with a large hematoma, which we now think is subdiaphragmatic and may be infected. The Chief of Medicine calls our attention to the fact, because of his history of possible amebic dysentery, even though the stools are negative for ameba, now that an amebic abscess of the liver must be considered.

We are making an incision parallel to the right rib margin with the idea of draining a subdiaphragmatic abscess. As we open the peritoneum, which is freely movable over a mass beneath, you will see the liver, which is of a very dark red color.

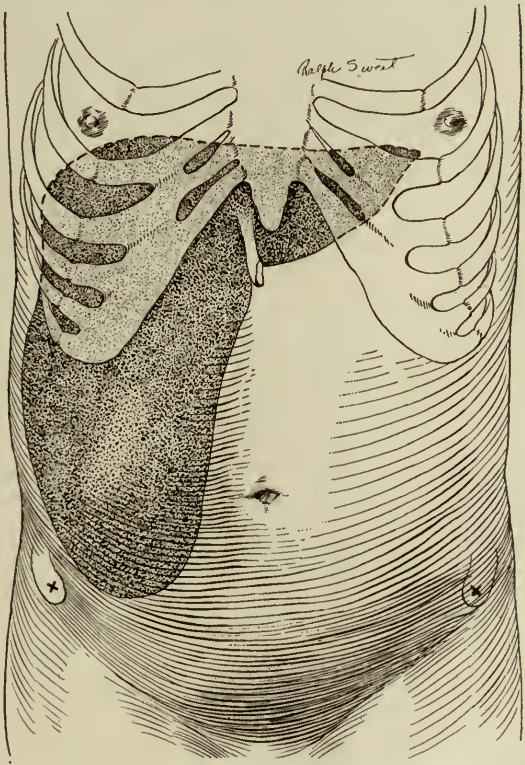

Fig. 301.—Diagrammatic appearance of enlarged liver at time of operation.

As we enlarge the incision reaching up under the diaphragm we meet with no adhesions. We are able to pass our hand all about an enormously enlarged liver with no adhesions anywhere. There is no abnormal mass in the region of the right kidney. By palpation of the liver at the site of the wound fluctuation is distinctly felt. We insert a trocar with tube attached and immediately you see a straw-colored fluid come out under marked pressure. We have removed what looks to be more than 1000 c.c. and the anesthetist informs us that the patient's pulse has jumped from 110 to 140. Because of the possibility of a secondary hemorrhage on relief of pressure we will clamp the tube and leave the trocar in, packing the wound open. We will remove the forceps and allow gradual drainage later.

Postoperative Notes.—The patient's temperature, which for a few days had been a degree above normal, gradually returned to normal, as also did his pulse after a week's time.

The fluid which was removed from the liver and saved at the time of operation measured 1500 c.c. of old blood-serum. We lost at least 100 c.c. on the table and are satisfied that at least another 1000 c.c. was drained from the liver during the following few days.

The red blood-cells in the urine gradually cleared and had disappeared when the patient was last seen. He made a rather rapid recovery from his shortness of breath and discomfort.

This case was reported because of the unusual rupture of the liver within its own capsule, causing a hemorrhage large enough to incapacitate the patient very soon after he was injured, and also because he suffered, which is also unusual, a rupture of both the right kidney and the liver apparently within their capsules at the same time.

GALL-STONE OBSTRUCTING SMALL BOWEL

This patient gives the following history:

She was born in Finland and is sixty-four years of age. She does not remember having any illnesses as a child. She married at the age of twenty-three years and had 5 children, the first of which was a forceps baby and weighed 14 pounds. After the birth of this child she remained in bed ten days. She remained in bed after the birth of the other 4 children only seven days for each.

She does not remember any real serious illnesses of any kind, but does remember that about six years ago she had some pain in the right side of her abdomen for which she did not go to bed. Six months ago she had this same uncertain pain in the right side of her abdomen, when she vomited three days and remained in bed eight days because the doctor made her do so, not because she felt she needed to.

Four days ago she was again taken with this pain in the right side, the localization of which is very indefinite, and started to vomit. She vomited until now. When I first saw her half an hour ago her vomitus was distinctly fecal material.

Strange to say, her general appearance, with a not unduly rapid heart, is out of all proportion to our diagnosis of obstruction of the bowel. She does not have the anxious appearance or the rapidity of the pulse which one would expect with such a condition. On account of her age our first impression would be that she is suffering from a probable malignancy causing the obstruction, but because of the fecal vomiting it is evident that the abdomen must be opened.

We are making a midline incision of considerable length because we believe that the larger the incision the quicker the inspection and the lessening of the danger to the patient from abuse of tissues. You will notice that the large bowel does not present, as one would expect should the obstruction be in the lower part of it, but here we do see numerous coils of small bowel considerably distended. As we pass our hand down and around we come upon what feels like a large spindle which is freely movable in the lower abdomen, and here we deliver a coil of small bowel and a hard spindle-shaped mass within its lumen. You will notice that the mass is reasonably freely movable within

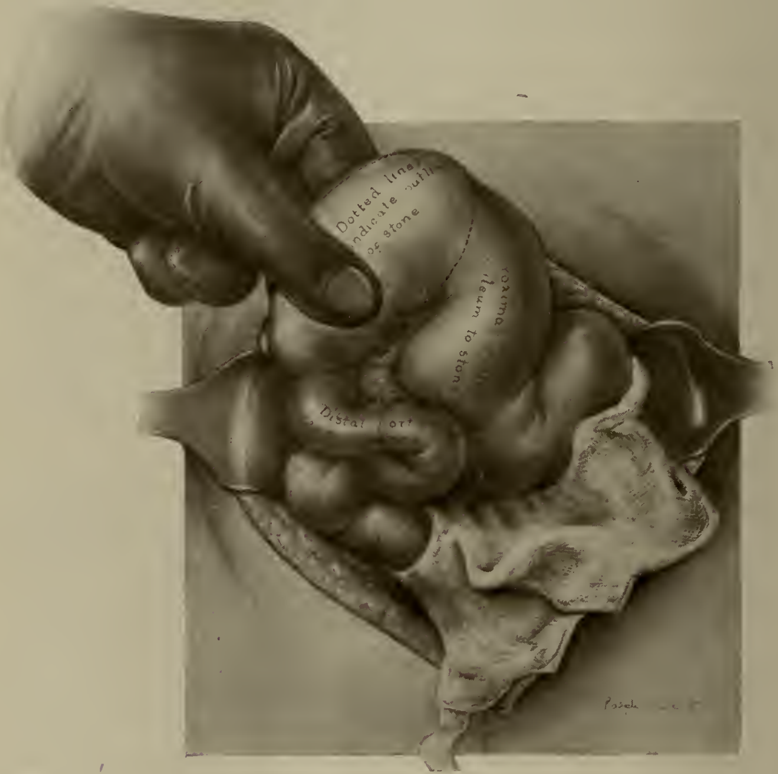

Fig. 302.—Appearance of bowel with contained gall-stone.

the bowel. We shall endeavor to work this mass toward the cecum. It can be seen that we are near the end of the ileum. As we push the foreign body along we find that it is stopped by an abnormal attachment of the mesentery to the posterior abdominal peritoneum. Upon more careful inspection it is discovered that we are within 2 feet of the end of the ileum. Our safest procedure now is to make an opening into the intestine and deliver the mass, which is done. We are closing the opening with a double row of catgut.

In spite of our efforts to pad off and protect the intestine from leakage a small amount has escaped. The intestine is returned to the abdomen, the large bowel inspected, and no other abnormality can be found. No other examination is deemed necessary and the abdomen is closed, with drain through the peritoneum.

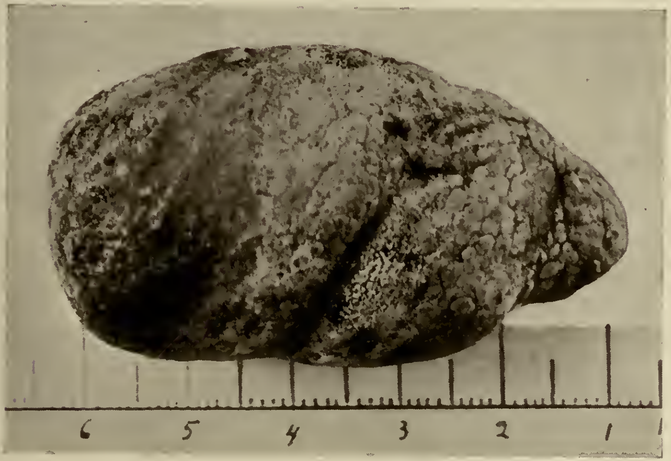

Fig. 303.—Gall-stone. Side view.

The mass delivered from the intestine we believe to be a gall-stone.

Postoperative Notes.—The patient's bowels moved freely within forty-eight hours and there was no further vomiting. On account of the leakage from the small bowel there was a marked infection of the whole wound which took some weeks to close. There was, however, no fecal fistula.

The specimen measured 5.4 cm. in length, 2.9 cm. in greatest diameter.

Weight: 10 grams.

Color: Grayish, mottled with yellow.

Sawn surface: Long crystals radiating from center, dark green in color.

Periphery: 2.5 mm. radially directed crystals light green to yellow.

Composition: 94 per cent. cholesterol; no ash.

This analysis proves the mass to be entirely a gall-stone without any accretion from its stay in the intestinal canal.

The remarkable thing about this record is that this patient never had symptoms of an illness in her upper right abdomen of a gall-stone sloughing from the gall-bladder into the small bowel, as we would have a right to expect.

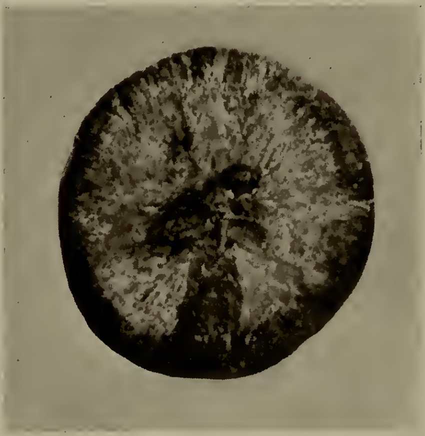

Fig. 304.—Gall-stone. Cross-section.

This patient was seen in the office several days ago in perfect health.

Some years ago we removed from the rectum of a patient in our office a very large gall-stone faceted on two surfaces, the only other specimen of the kind we have seen. That patient gave a history of having carried the foreign body for some years in the rectum and also gave a history of having had many years before a very definite and dangerous illness which involved her upper right abdomen, called at the time "inflammation of the bowels."

CLINIC OF DR. LEO ELOESSER

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ANEURYSM OF THE COMMON ILIAC ARTERY: GRADUAL OCCLUSION BY LIGATION WITH A FREE GRAFT OF MUSCLE

It is an enviable thing for a man so to have set his mark and imprint on a field that all who follow him into it may recognize their trespass and his proprietorship. Halsted has done this for ileofemoral aneurysm and ligation of the common iliac arteries.[1]

In reviewing the iliac ligations of the century that lay between Gibson's first operation in 1812 and Halsted's publication in 1912 Halsted was able to add to the 62 cases accumulated by his predecessors, Smith and Kümmel, 30 new ones. Among these 92 ligations there was but one (Trendelenburg's), and that fatal, performed for aneurysm of the common iliac. Ligation of the common iliac artery, therefore, is a rare operation and aneurysm of the common iliac a rare disease.

Lucke and Rea's[2] statistics give a further estimate of how rare this aneurysm is. Among 12,000 Philadelphia necropsies they found 321 intracorporeal aneurysms; of these, 15 affected the heart; 278, the aorta, and 28, the aortic branches; among these 28 there was one of the internal iliac artery, but none at all of the common. Grisp[3] in 1851 was able to gather 702 aneurysms. He cites but 2 cases of common iliac aneurysm against 314 aortic and 182 popliteal ones. His data are based mainly on clinical reports; their accuracy is, therefore, open to question.

The results of war injuries to the vessels, once they are collected, will probably further increase the reported numbers of spurious and arteriovenous aneurysms. In the literature at my disposal I find 3 cases mentioned. Orth[4] reports a gunshot wound causing a rupture of the common iliac artery and vein.

He tied both vessels. The man recovered, but died four months later of pulmonary tuberculosis. Orth's report is short and the anatomy of the injury is not made quite clear. v. Haberer[5] treated an arteriovenous aneurysm of the common iliac and the inferior vena cava by suture. Moncany[6] reports an aneurysm diagnosed as originating from the common iliac. The man was not operated upon, and the diagnosis is open to doubt. Ranzi's[7] paper contains 5 histories of iliac aneurysm, but these 5 are all probably aneurysms of the external iliac artery.

In the recent literature there are a few reports of spontaneous aneurysm of the common iliac. Haythorn[8] found at the autopsy of a man who died of biliary tuberculosis a small tuberculous aneurysm of the common iliac which contained a caseous thrombus. Maurel[9] reports a common iliac aneurysm; DiPoggio[10] another, a syphilitic one.

I can find reported no case surviving operation for true aneurysm of the common iliac artery. The rarity, then, of aneurysms of this vessel should justify presenting our patient.

Mr. D., an American sixty years of age, came to me on November 17, 1922. As a boy he had been seriously ill with scarlet fever; he bled from his kidneys for two or three weeks at this time. He had also had ozena as a boy, and had been troubled with his nose and throat all his life. In 1893 he had a mild attack of grip.

He had coughed more or less for many years and at times had brought up some blood. Dr. Harold Hill, who saw him some five or six years ago, had demonstrated tubercle bacilli in the sputum. For many years, however, he seems to have carried his pulmonary infection innocently about with him. He smoked, drank a clubman's quota of alcohol, and kept late hours with no apparent harm either from his mode of living or from the disease of his lungs. His tuberculosis was evidently of a chronic fibrous type.

He had had no other infectious diseases—no typhoid, no malaria, no dysentery, and no venereal disease. Several Wassermann tests had been negative.

He had always been robust and vigorous, and, indeed, still was so in spite of the pain and sleepless nights that his enormous aneurysm had lately caused.

In 1918, four years before I saw him, he had some abdominal pain, but attributed it to gas and paid little attention to it; his abdomen was not distended. A month or so after the onset of the pain he was attacked suddenly, while driving downtown in a taxicab, with violent pain in the left groin. He ordered the driver to return home, and, getting out of the cab, fainted on the threshold of his house. His family physician, Dr. Herzstein, was called, who took him to a sanitarium. In a few days his abdomen became enormously distended with gas, but under medical treatment the distention gradually receded. Two surgeons were called in consultation and told Mr. D. that he was suffering from a diverticulitis, having noticed a swelling of the left lower abdomen and left groin. Dr. Herzstein auscultated this swelling, but could hear no bruit. There may have been a degree or so of fever, but not more. During the first day the patient could not pass his urine and was once catheterized; after this he had no trouble with his bladder. There was no blood noticed in the stool.

The patient was in the hospital for a month, when he got up and felt fairly well. A month later the left leg suddenly began to swell, without fever and without pain. He returned to the hospital for about a month, but when the swelling did not recede he took matters into his own hands and had his leg baked and massaged by a masseur. The swelling gradually disappeared and he felt fairly well for about three years, except for occasional pain in the lower part of his back, affecting both sides equally.

In July, 1922, during a long drive over rough country roads, the pain in the back increased. On arriving at his destination he sat up all night. By the next day the pain was so severe that he had to return to town. He went home and to bed. About three days later Dr. Herzstein saw him, and noticed for the first time, after giving him a physic, that the stool contained large amounts of mucus. The patient suffered from constant tenesmus and a feeling of pressure over the bladder; the end of micturition was difficult. A few days later his nurse noticed a black discoloration of the perineum, which gradually spread until his hips and flanks were black and blue. At the same time he again noticed a swelling in the left lower abdomen, extending farther toward the midline than had the swelling of three years previous. An *x*-ray of the colon showed a low obstruction, diagnosed as probable carcinoma. The surgical consultant said that the mass which he had felt at the former examination had increased in size, and recommended laparotomy. The patient did not accept operation and went back to his masseur. The abdominal distention, the feeling of pressure in the rectum and bladder continuing, he sought my advice. The previous week both legs had begun to swell; the swelling was greatest at the end of the day and disappeared after rest in bed. The patient was inclined to attribute the onset of the last attack of abdominal pain and swelling of the legs to a troublesome cough that accompanied his first attack and had continued at intervals since. He felt rather tired, but less so than when being purged; he suffered moderate dyspnea on exertion; he was about 15 pounds underweight. Urinary frequency had continued; he got up about every two hours during the night. He took two *x*-ray treatments for his tumor, but had a severe reaction after each of them.

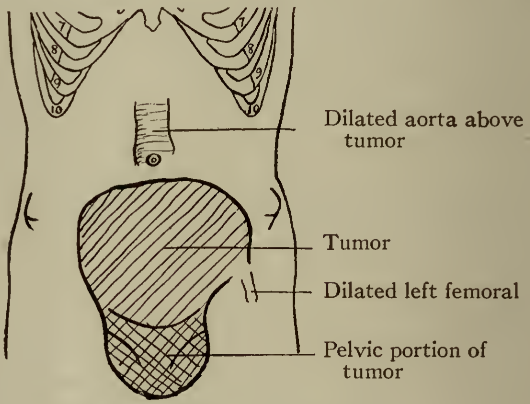

Fig. 305.—Tumor as palpated before operation.

I found Mr. D. to be a well-nourished, robustly built man. His temperature was 97.8° F.; his pulse 80, the wave was dicrotic; blood-pressure 146 systolic.

The fingers were a little cyanotic. The lungs, at various examinations, showed diffuse dry crackling râles. The apex of the heart lay about ½ inch to the left of the left nipple; the right border 1 inch to the right of the sternum. There were no murmurs. Both legs were edematous.

The lower half of the abdomen protruded, the upper half was rather drawn in. Both flanks bulged a little. A sharp and smooth liver edge could be felt coming down about an inch under the ribs. The spleen was not palpable.

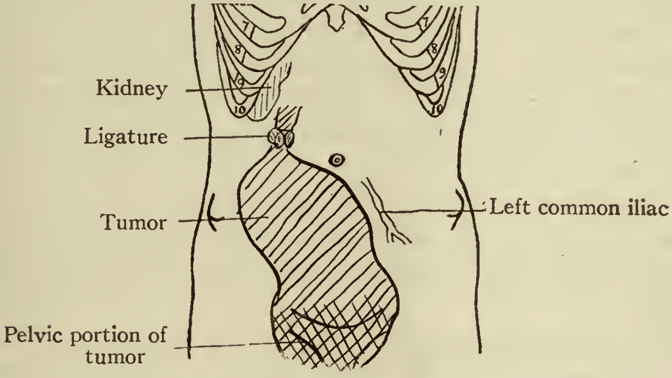

Fig. 306.—Tumor as found at operation.

A huge pulsating expansile mass, so tense and beating so strongly as to make one recoil from palpation with surprise, filled the lower abdomen. It was better defined after I had put the patient to bed for a few days. The notes made on November 19, 1922 state: "The tumor is better, palpable, and softer. It fills the lower abdomen to within 1½ inches of the navel. It fills the whole pelvis and rises above the pubes in approximately the midline, perhaps a little more to the left than to the right. It can be felt per rectum almost immediately above the anus. It beats with great force, especially above the symphysis, where it seems to lie especially close to the examining hand; it also beats forcefully against the finger introduced per rectum. The pulsation is so strong that it cannot only be felt, but immediately strikes the eye. In spite of this strong pulsation—or perhaps because of it—there is no murmur or thrill or bruit either audible or palpable. Just above the pubes the abdominal wall is a little brawny and indurated; otherwise it is normal. Above the tumor one can feel the aorta pulsate; it seems dilated for an inch or so above the navel; higher than this its caliber feels about normal. The left femoral artery is distinctly larger than the right and measures about $\frac{3}{4}$ inch across. The expansile pulsation seems to go directly over into it."

After a day in bed, measured while recumbent, some heartbeats came through to the wrist at 130 systolic pressure, and all of them at 122. Compression of both femorals had no apparent effect on the blood-pressure or pulse-rate.

There was a good pulse in the right dorsalis pedis artery; the left was barely palpable at times, at others not at all. Both posterior tibials pulsated.

The blood examination showed: Hgl., 75 per cent.; red blood-cells, 4,000,000; white blood-cells 6400; pulse, 67; small lymphocytes, 15; large lymphocytes, 14; transitionals, 1; eosinophils, 3.

The urine was normal except for a few hyaline casts.

Previous films of the chest showed extensive mottling of both apices, probably old tuberculosis.

An *x*-ray examination on November 20, 1922 showed a wide aortic arch. After insufflating the colon with air Dr. Cook reported a pulsating tumor of the lower abdomen, developed mainly on the left, reaching 1 inch below the navel. Pulsation in the upper part of the abdomen could not be seen; in the lower part, where the colon contained more air, it was clearly visible. The liver came down about 1 inch below the ribs.

Dr. A. W. Hewlett, whom I asked to see Mr. D., agreed with my findings and my diagnosis of aneurysm of one of the left iliac arteries. He made a very grave prognosis.

My patient, like his unforgettable fellow sufferer Israel Crane, the first man to survive a common iliac ligature, may be described with the words that Valentine Mott used for Crane, as "a man of great composure." And further to quote Mott, "He was now informed of the serious nature of his case and that without an operation very little chance of his life remained. . . . From the extent and situation of the tumor, he was apprised of the uncertain nature of the operation, as well as of the difficulty of performing it." I cannot add "and, indeed, it would require an artery to be tied which never had been operated upon for aneurysm," but the statement "never had been successfully operated upon for an aneurysm of this kind and size" would probably have been correct.

I presented these facts to the patient, gave him what statistics I could, and stated that I could not urge an operation of such risk, but should be willing to undertake it if he so wished. He left the hospital to consider it.

I must confess that the notion of operating upon this huge and inaccessible aneurysm caused me more trepidation and anxiety than were apparent in Mr. D. himself. In ten days he returned and said that he was ready.

On December 7, 1922 I operated. Dr. Mary Botsford's skill in administering gas and oxygen anesthesia was an invaluable support.

Operation.—Under good gas and local anesthesia, with $\frac{1}{4}$ plus $\frac{1}{4}$ gr. morphin, and after infiltrating the skin with novocain and adrenalin, an incision was made in the left flank to expose the pulsating tumor which was thought to be an aneurysm of the left iliac artery. The external oblique as well as the internal and transverse were split in the direction of their fibers and a triangular flap turned down, after Kocher, by incising the rectus sheath downward toward Poupart's ligament. This did not expose the contents of the left iliac fossa as well as the incision used by Chevassu for carcinoma of the testicle. The peritoneum pushed forward was adherent to the fossa by a good many strands, and the ureter, instead of going along with the peritoneum, remained behind. The left iliac artery exposed was seen to be normal, the left vein not dilated. The pulsating tumor pushed upward out of the belly with the hand was felt to beat under the peritoneum and was not connected with the left iliac vessels. The peritoneum was therefore opened and the tumor palpated with the hand. It filled the whole pelvis and ran upward to the right flank, far toward the right kidney. Here there was felt a large artery which, on being compressed with the thumb, stopped the beating of the whole large tumor mass. This incision was, therefore, closed, the muscles being united in their proper layers with chromic gut. Dr. Botsford, on being asked whether the patient would stand an opening of the right flank, or whether she thought it safer to defer the operation for a week, replied that she thought he would be better able to withstand a similar procedure on the other side now than he would a week later. The man was therefore turned about on the left side and a similar but larger incision made, following the right Poupart ligament, an inch above it, then upward toward the rib margin, and again backward for 2 inches. The muscles were again separated and the rectus sheath divided according to Kocher, the lower fibers of the external oblique being later cut across so as to gain better exposure of the upper flank. After pushing the peritoneum forward an immensely dilated blue iliac vein appeared, the thickness of a large thumb, and medial to it an enormous pulsating tumor whose outer surface was covered with many blood-vessels running longitudinally. The walls of this aneurysm were thin and soft and contained no chalky deposits. With the forefinger the tumor was followed upward, its pedicle lying under the small and rather hard right kidney, whose capsule was opened, letting out some of the perineal fat. On compressing the arterial pedicle the pulse in the tumor again stopped. Cautiously now, the palm of the hand lying on the huge pulsating mass, this pedicle was freed, and little by little the index-finger hooked completely around it, working from the outer side toward the midline. After it was surrounded by the finger the pedicle could be compressed between the forefinger and thumb, but it lay so far upward, and at such a depth, that the whole hand up to the level of the wrist had disappeared in the wound. After several trials, a large aneurysm needle, loaded with a double strand of stout gut, was passed around the afferent artery, its tip being guarded by the tip of the left index-finger. With some difficulty the catgut projecting from the needle was wound around the finger-tip and the needle withdrawn. Into the noose two further loops of stout gut were laid and then drawn back around the artery. One of them was stitched with a mattress-suture into a large slice (about 4 inches long and 1 inch thick) which had been cut from the tendon and belly of the external oblique, and this, with much difficulty, was drawn back around the artery by the stitch fastened to one end. With the index-finger this free muscle graft was partly pulled, partly pushed through the space around the artery which the dissecting finger had prepared for it. The stitch was then tied around the free end of the graft. The sling thus formed was not tight enough to stop the pulse in the tumor. It was, therefore, pulled upward by an assistant and a second ligature of stout gut passed around it. This stopped the pulse in the aneurysm. It was curious to note that while this constricting loop of muscle tissue was drawn upward, partially occluding the pulse in the aneurysm, a thrill was felt in the sac, which had originally had a pulsation, but no thrill. The wound in the right flank was closed in layers as the left had been and the patient was put to bed awake. His pulse after the occlusion of the left iliac artery, if this it was that had been tied, was slower than before. The artery that fed the aneurysm lay unusually high for an iliac. It seemed as though it might have been an artery coming off from the right renal, if such an anomaly of the iliac origin occurs. The artery was not normal at the site of ligature; it was as large as a garden hose, its lumen was perhaps an inch or more in diameter. The operation lasted four hours and was dangerous and difficult.

The postoperative diagnosis, therefore, was: Saccular aneurysm of the *right* common iliac artery.

In reviewing these notes after operation I do not see how I could have avoided my regrettable error in diagnosing the aneurysm as one of the left instead of the right iliac vessel, an error which needlessly prolonged and complicated an operation at best so hazardous. The absence of the pulse in the left foot as well as the left-sided development of the aneurysm, which had felt as though it went directly over into the dilated left femoral artery, had led me to believe that it originated from a left iliac vessel. The left iliac artery was probably pressed by the large tumor against the bony wall of the pelvis and its lumen narrowed, whereas the force of the blood-stream in the smooth and open aneurysm of the right iliac was unchanged. This compression of the left iliac was, I fancy, the reason that the pulse in the left leg and foot was weaker than in the right. Nor do I know how it would have been feasible to ascertain had I been in doubt, which I was not, from which side the aneurysm sprang. An attempt at manual compression of the iliacs through the belly wall with this thin tumor underneath would surely have been inadvisable. Indeed, the mass seemed so nearly ready to burst, and the blood in it beat so strongly, that I went at its palpation very gingerly and with fear that I might do harm. One touch of the belly was enough to instill trepidation into any surgeon.

The error in diagnosis determined my choice of approach to the tumor. The incision in the left groin and flank was, of course, unnecessary. Had I begun operation doubtful of the side from which the tumor came, I should have made my approach across the belly in the midline, either vertically or transversely, with a Pfannenstiel incision, which might subsequently have been carried outward to one side or the other.

As it was, I do not know whether a laparotomy, once I had closed the left flank, would have been better than the right retroperitoneal incision, insufficient as the exposure was that I had from it. The tumor rose so high that it would have covered an iliac pedicle from the front. It would have been necessary in order to empty the sac to have put a temporary ligature around the aorta. Whether the patient would have stood this additional strain and the postoperative distention following laparotomy as well is a question. However, it is certain that a long laparotomy incision would have allowed me more freedom and a better oversight.

The pedicle of the aneurysm lay so high that I was sure, after operation, that I had to deal with some anomaly of the iliac vessels. Henle gives a list of such anomalies, including instances of bifurcation of the aorta as high as the second lumbar vertebral body.

The dilatation of the vessel leading to the aneurysm and the thin vessel wall forced me to adopt some method of occlusion other than that of ligature with silk or catgut. As far up as I could possibly reach and farther the iliac artery was dilated to three or four times its normal caliber; its wall, which was fortunately elastic and free of chalky plaques, was so thin that I was in great dread, after having isolated it, that it would tear apart under my fingers. The operation, therefore, followed rather Anel's, who tied the vessel close to the aneurysm, than Hunter's, who ligated at the site of election, choosing for ligation a healthy vessel at a distance from the tumor. I was afraid, therefore, that the dilated, thin-walled, and unhealthy vessel would rapidly cut through if I tied it off with a thin ligature. Owing to the depth of the wound and the impossibility of conducting the ligature under the guidance of the eye the vessel could not be freed sufficiently to wind around it in a spiral a strip of organic material, say fascia, after the manner of Halsted. Choosing, therefore, for a living ligature a material which lay abundantly at hand, which I was able to get in sufficient bulk and thickness to ensure against erosion and in sufficient length to enable me easily to encircle the artery with it, and which I calculated would shrink rather than give in the days following operation, I selected muscle for my graft. I reckoned that transplanted muscle would rapidly become fibrous and shrink, making an occlusion which might grow tighter in the first few days or weeks. I encircled the vessel with the thick muscle ligature, and then stitched its ends together with a mattress-suture so that they might not slip apart.

It will be noted in the course of observation that the pulse in the aneurysm, which had disappeared when I finally applied the last tie to the muscle ligature, returned an hour later, but that it gradually disappeared from the arteries of the right leg from the groin down and has remained absent. The return of the pulse in the aneurysm is probably due to blood flowing into it from the various subsidiary channels, from the epigastric artery through its anastomoses with the mammary, through the lumbar vessels, through anastomoses with the hypogastric of the same, and of the contralateral side. The alarming thump of the aneurysmal pulse, however, has been checked permanently since the operation. It may be objected that I am mistaken in my estimation of the force of the aneurysmal pulse before and after operation and that my desire to find it weaker has misled me. The disappearance of the right femoral pulse from a little below the groin down, and the disappearance of the popliteal and tibial pulse allow of no mistake. Since occlusion of the main parent artery of the right leg the blood-stream below it has not had sufficient force to raise the walls of the main arteries of this leg to a pulse-beat.

The absence of any thrill, bruit, or murmur in this large pulsating aneurysm is noteworthy; it is still more noteworthy that the thrill should have appeared for an instant only, while the occluding loop of muscle was being drawn up and tightened, and that finally, after it had been tightened, the thrill should have disappeared again.

We are still ignorant of the cause of vascular thrills and murmurs. Both their presence and their absence have given rise to mistakes in the diagnosis of aneurysm, and have been subjects of considerable conjecture. The problem of vascular murmurs is so far from solution that Exner was led to remark, "One might enquire not so much why certain diseased arteries do give rise to a murmur, as why every normal artery does not."

Stich and Fomme,[11] in their work on injuries of the blood-vessels and their sequels (aneurysm), cite a dozen cases of thrills and murmurs leading to a diagnosis of aneurysm. At operation no aneurysm was found, but various, more or less indefinite changes in the vessels, such as constriction by scar, tortuosity due to excessive shortening after fracture of the femur, and questionable dilatation or lengthening of the artery. The presence of a bruit caused these errors, distressing and embarrassing at times, but of no grave consequence. The opposite mistake—of failing to diagnose aneurysm because of the absence of a bruit or murmur—is more serious and has brought on avoidable fatalities.

The aneurysmal bruit seems to be not uncommonly absent. Sir John Erichsen said "that this especially happens in sacculated aneurysms with small mouths, or in those that are much distended with coagula or blood," and "thus, for instance, it not infrequently happens that, in an aneurysm of the ham or thigh no bruit, or but a very faint one, is audible so long as the patient is standing; but if he lie down, and elevate the limb so as to partly empty the sac, then it may be distinctly heard."

There was no murmur or thrill to be heard in Mr. D.'s aneurysm either while he was standing or recumbent. The thrill, however, appeared, just as it did in Halsted's experiments, at one particular degree of occlusion of the artery. Now, with all our ignorance of the cause of vascular murmurs, we do know that certain factors are necessary for their appearance: first, a certain swiftness of the blood-stream, and second—probably—certain irregularities of the vessel wall. It was not sluggishness of the current in the aneurysm that accounted for the absence of a bruit in our patient. This is proved by the bruit's appearing when the artery was constricted, *i. e.*, the current made more sluggish rather than hastened. I should be more inclined to ascribe its absence to the arteries being soft and smooth, and free of plaques or atheroma. And it may well be this same smoothness of the vessel wall, which kept the blood in the huge sac liquid and free of clots, that made entirely unlikely a spontaneous cure by coagulation.

It is impossible to determine the cause of this aneurysm. Nothing speaks for syphilis; there is no history of venereal disease; repeated Wassermann tests have been negative; the changes in the arteries themselves were quite unlike syphilitic ones—there were no atheromatous plaques, but a wide-spread and generalized dilatation. A number of authors, among them Haythorn, have called attention to tuberculosis as a factor in aneurysm. Haythorn considers tubercular aneurysms to be due to four groups of causes: (1) Miliary tuberculosis of the intima; (2) tubercular polyps attached to the intima; (3) tuberculosis of the arterial wall involving the several layers; (4) aneurysms whose walls are composed of tubercular tissue, *i. e.*, invasion of the wall of an artery by a cold abscess or a caseating focus.

Mr. D.'s aneurysm did not fall into any of these groups, as far as could be discovered. His postoperative recovery rules out 1 and 2. Tuberculosis of the vessel wall is unlikely considering the huge size of the aneurysm. We had no evidence at operation of a cold abscess or tubercular focus lying near or encroaching on the artery. A sinus which formed in the left flank after operation, however, makes the cause of this fourth group a possibility to be considered. The diffuse thinning of the vessel walls and the dilatation not only of the right iliac but of the left femoral and the aortic arch would make one inclined to seek the cause not in a disease localized at a particular spot in one artery, but rather in a vascular weakness, either congenital or produced by a protracted cause—and this might possibly lie in the pulmonary tuberculosis which he has carried for many years.

Course.—Four hours after operation the left posterior tibial artery pulsated, but not the right (which before operation had had the better pulse). Both feet were cool, but not livid.

Eight hours after operation the left femoral pulse was good, the right was very small. The patient was weak and tired, but said he felt hungry and had a good slow pulse. Every fifteen to forty-five minutes he cried out with a sharp spasm of pain across the lower belly. He could move his feet and toes.

The day after operation (December 8th): Tumor still pulsates. At 9.30 to 10 P. M., after receiving an injection of morphin, there was a great increase in the pulse-rate and a very weak pulse. I saw him at 11 P. M. At this time the spasms of which he previously complained had become fewer, and the patient, who had been restless at first after the pulse went up, was in an alarming collapse, with cold hands and sweating profusely. He passed gas spontaneously and had very little belching. I gave him strophanthin 1 mg. in two doses of $\frac{1}{2}$ mg. each, with an hour between, whereupon his pulse became a little fuller, but remained rapid. When the attack first came on the nurse said it was scarcely perceptible. During the night he had injections of caffein and black coffee by mouth.

December 9th: Early this morning Dr. Hewlett saw him, and considered, in view of the collapse coming on so late, that it was more likely to have been produced by hemorrhage than by shock, and advised transfusion. I did a direct transfusion, vein to vein, from a Group IV donor. The patient's pulse did not improve during the transfusion and the donor was not visibly affected thereby. Considering the uncertainty of this method, I asked Dr. Kistler to do a transfusion with the Kimpton-Brown tubes, admitting 750 c.c. into the patient's vein. Upon this, although his pulse-rate was not markedly diminished, the volume was much better and the patient was visibly brighter. At the onset of this attack he complained of an itching and burning of his legs; the legs, however, were not gangrenous. The hemorrhage, if there was one, probably came from some of the retroperitoneal veins. The conjunctivæ were not sallow, as in the absorption of a large clot.

December 11th: Patient can turn with ease. Spasms of pain have stopped. Leg warm.

About December 18th an effusion appeared in the left knee. This was tapped and the fluid sent to Dr. Dickson, who reported:

The fluid was turbid and mucinous. Smears showed very many pus-cells, but only an occasional endothelial cell or lymphocyte. No acid-fast bacilli or other bacteria were seen in spite of repeated and prolonged search of several slides.

Aërobic cultures on blood-agar and in calcium carbonate broth, and anaërobic cultures in enriched agar were prepared. None of the cultures showed any growth in seventy-two hours.

Guinea-pig No. 1 (new series) was injected.

(On January 8, 1923 Dr. Dickson reported that Guinea-pig No. 1 died within two weeks of the date of injection and showed no signs of tuberculosis or other infection. No cause for death was determined.)

From this time on Mr. D.'s recovery was uneventful. The temperature never rose above 99.5° F. The cause of the sudden collapse coming on thirty hours after operation remains undetermined. There was no subsequent evidence of a profuse internal hemorrhage. The urine, examined ten days later, was free from urobilin.

There was never any occasion to fear gangrene of the right leg or foot.

December 20th: Stitches removed. Wounds healed. Slight edema of both legs.

December 26th: Mild attack of thrombophlebitis in varicose veins of the right leg, with slight fever (99° F.). Mass in abdomen still pulsates; not much smaller than before operation.

January 8, 1923: Pulse in right femoral decidedly smaller than on left; left popliteal, posterior tibial, and dorsalis pedis pulsate well; none of these arteries pulsates on the right side.

January 9th: Left hospital.

February 6th: After an automobile ride about a dram of pus appeared in the left scar. Smear showed no bacteria.

February 11th: Tumor decidedly smaller. Decrease especially noticeable per rectum.

Since this the tumor has steadily decreased. It is still palpable above the pubes to within 2 inches below the navel, and may be felt per rectum at the very tip of the finger. It is softer and the force of its pulsation is diminished.

The right femoral can be felt to pulsate for about 1 inch below Poupart's ligament; below this level there is no pulse in any of the arteries of the right leg. The left femoral, whose caliber, it will be remembered, is larger than normal, can be felt half-way down the thigh to Hunter's canal; the left popliteal, posterior tibial, and dorsalis pedis arteries all pulsate.

Both legs are still edematous; they swell unless the patient keeps them wrapped. He does not complain of cramps in the legs; neither leg is cold; they show no evidence of insufficient arterial blood-supply.

He has had no further trouble with bowels or bladder, and has regained his original weight. His cough is still troublesome at times. He is up eight to ten hours and attends his business office daily.

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HEAD INJURIES. INDICATIONS FOR SURGICAL TREATMENT

In the main there is a fairly general agreement that depressed fractures should have the depression relieved; that perforating and penetrating wounds should be surgically cleaned at the earliest opportunity. There is not the same divergence of opinion regarding the surgical handling of these cases nor the difficulty in decisions that there is in another larger group.

It is the case that is brought in without a skull depression or a penetrating wound and is in a serious condition from a head injury that taxes our judgment and makes decision difficult. In such cases there is usually a fissured fracture or fractures of the vault or base. The evidence of the former is found in the hemorrhage beneath the scalp along the area of bleeding, recognizable by the pitting on pressure over this area. The associated tenderness along the line of fracture assists us in the conscious patient. Roentgenograms of each side of the skull and the front and back add to our clinical information. Diploic and arterial vessel markings of the skull can ordinarily be differentiated from the fracture lines.

With the fractures of the base, the bleeding from the ears, the later ecchymoses over mastoid, and the horseshoe ecchymoses from it around the auditory meatus attract attention to the fissures of the petrous bone. The bleeding from the nose or vomiting of swallowed blood, the ecchymoses, subpalpebral and subconjunctival, in the absence of direct injury to the soft tissues, are important findings, and assist us in forming a judgment of the bone injury to sphenoid, ethmoid, and orbital plates. Additional information may come from the character of other discharges from these orifices, from other ecchymoses, emphysema, etc. The roentgenograms help us less.

Such examinations and findings give information as to the severity of the trauma. Such bone injury, however, bears little relation to the intracranial injury. The most severe brain injuries are often seen and later found to not be associated with any bone injury. A policemen's club may cause by a sharp blow a fracture without generalized brain contusion, where a thud of a sand-bag may widely disorganize the brain and yet produce no bone injury. Compression of a skull between a ship's side and the pier may compress and fissure the skull widely and yet produce no brain injury. The type of trauma more often than the degree of bone injury is indicative of the brain damage. On the other hand, the bone injuries, particularly of the base, which may open avenues of infection to the meninges, are factors affecting our prognosis.

Fissured fractures *per se* require no operative treatment. What intracranial conditions can be helped surgically? Widespread brain contusions, lacerations, and free hemorrhages are rapidly fatal. These are present in the patients who after severe head injuries remain unconscious, with a low blood-pressure, rapid pulse, and from a subnormal temperature climb rapidly to a high one, with a fatal ending.

In an injury so severe that the patient shows no signs of reacting to it, surgical efforts can offer little. Exposure of the brain in such a case may show an intracranial pressure below normal, the brain plum colored, disorganized or lacerated, free blood in the cranium, and venous congestion. Far from there being increased intracranial pressure, the dura may be lax, and opening of it shows an actual space between the dura and the low-tension brain.

In such the fatal outcome is due to the patient's "shock," if we may use the term, to his low blood-pressure, and the pulped brain. With a lesser degree of "shock" and with evidence of the patient beginning to react, then perhaps withdrawal of the free fluid within the cranial cavity might lessen the degree of intracranial pressure for him to combat. Before this stage there is no increased intracranial pressure to relieve. It is already below normal.

In the larger number of patients who do not have this great degree of brain injury and yet have serious damage we are constantly watching for developments that may be within our control.

What are the indications for surgical intervention? Intracranial pressure first comes to mind. Intracranial pressure is dependent upon various factors and varies greatly in degree. Within some measure at least it is within our control.

In the clinical signs upon which judgment of pressure is based we have come to rely upon the slow pulse, increasing pulse pressure, deepening stupor, rising blood-pressure, altered respirations (sometimes of the Cheyne-Stokes type), rhythmic recurring restlessness, and direct estimation with the spinal manometer. The value of the ophthalmoscopic indications of intracranial pressure as shown by venous engorgement, hyperemia, and later swelling of the optic disks is of the greatest value, but unfortunately helps us but little in the recent injuries. It appears later, and the longer the time from injury, the more apt are we to find it. It is unusual, however, to receive much help in the first twenty-four or forty-eight hours after the trauma. Later it is of increasing importance.

A host of experimental workers have established the physiologic responses to intracranial pressure and emphasized the slow pulse, the rising blood-pressure, the altered respirations, the Traube-Herring waves, etc. A large amount of excellent work has confirmed these findings.

In our own laboratory we have been impressed, however, by an additional occurrence which seems to be of clinical importance. Coincident with the slowing of the pulse, which appears early in the stages of intracranial pressure, we have noted an increase in pulse-pressure. The striking rises in mean blood-pressure come with greater rises in intracranial pressure. The ready clinical observation of increased pulse-pressure supports the experimental finding and is one of the signs which may prove of considerable value. In the clinical cases to which it has been applied an approach of the pulse-rate to the pulse-pressure has indicated a considerable intracranial pressure.

When experimentally intracranial pressure is increased to the point where a sustained rise of blood-pressure by the animal cannot be continuously maintained, a rhythmic cycle—the Traube-Herring waves—appear. The rhythmic rise and fall of the blood-pressure is accompanied by other signs. During the greatest height of the blood-pressure waves blood reaches the intracranial contents. The clinical expression of this may be shown by a lessening of the patient's stupor. He may moan or thrash about, respirations may deepen, pupils contract, and reflexes return. During the down wave, when the blood-pressure is at its low level, coma may be complete, the pupils dilate, apnea and abolished reflexes appear. Such responses cannot escape observation. Usually, however, the responses are not as classical. Anyone seeing many cases of head injury is familiar with the patient, who at short intervals thrashes in bed, moans, and wards off the examiner, and between times lies stuporously. Restless irritability is common in brain injuries, but rhythmic recurring restlessness at short intervals is frequently seen, and we have come to believe is clinical expression of the Traube-Herring waves of the physiologists.

Slowing of the pulse, if slowing is taken to mean a pulse under 60, is one of the earliest signs of pressure, but taken alone is not, we feel, sufficient to form a judgment. A pulse dropping down to 52 or 54 in six or eight hours after injury and without other clinical findings is too common to need special comment. With further slowing or in association with other signs it is of value.

Loss of consciousness is of far more complicated etiology than would permit one to attribute it to intracranial pressure, but with a return to consciousness after the original injury and then a gradually deepening stupor in association with slowing of the pulse or other signs of pressure it is of great value as an indication of pressure.

The rise in mean blood-pressure is not a constant finding in intracranial pressure, and ordinarily we are without a knowledge of the patient's usual pressure. A climbing blood-pressure when found is of more value.

The advanced clinical picture of acute cerebral compression manifested by a coma, slow pulse, high pulse-pressure, high blood-pressure, Cheyne-Stokes' respiration, and the associated findings represent the extreme of the patient's ability to compensate for the pressure. If within our observation and our power to prevent it, such an advanced state of pressure should not be permitted to occur. Recognition of the earlier signs gives us an opportunity to combat this advance.

Perhaps the direct reading of the intracranial pressure by the spinal fluid manometer deserves more prominent mention. In its use, however, the frequency of irritability, restlessness, and lack of control of the patient make it often impracticable.

It is our belief, too, that the patient's reaction to the intracranial pressure is the primary consideration rather than the millimeters of pressure read. The reaction of patient A to acute cerebral compression gives a very different clinical response from the reaction of patient B with a brain tumor, although the spinal fluid manometer readings may be identical.

These experimental and clinical facts give us our basis for forming a judgment in our surgical cases, but even with these facts before us judgment is difficult, for it is to be remembered that these responses obtained in the experimental laboratory are the responses of previously normal brains. At least they are the responses of brains not previously traumatized. In dealing with varying degrees of intracranial contusion we can hardly expect a damaged brain to always respond "normally," so that often we are confused. These physiologic facts, however, give us our basis for judgment.

In affording relief from acute intracranial pressure our selection of cases for surgical treatment does not depend altogether upon the presence of signs of pressure, but upon whether those signs are increasing or subsiding.

If a patient is seen, for example, twenty-four hours after injury with a pulse which had progressively slowed to 48 or thereabouts, with increasing pulse-pressure approaching the same figure, and with rapidly deepening stupor, some measure to relieve this pressure would be urgent.

If, on the other hand, with the same pulse-rate the pulse-pressure was lowering, the stupor lessening, and the patient improving, one would at least feel much less apprehensive and feel justified in awaiting further change.

In brief, in the borderline cases the determining factor is the way the signs are progressing rather than the signs themselves.

In the more advanced pressure cases we feel that an immediate attempt at relief should be made.

When the patient has run the gamut of increasing intracranial pressure signs and can no longer compensate for it through vasoregulation, the terminal state of automatic action of those centers with a climbing pulse-rate, lowering blood-pressure, and irregular respiration indicates the approaching end, and surgical efforts are of little avail.

Nothing of the purely neurologic aspect of these cases has been mentioned. It seems to us that primarily one needs to think in terms of physiology rather than neurology. For the surgeon the gross neurologic findings, such as a hemiplegia present or increasing, should be readily recognized and would affect his judgment. While the value of a thorough neurologic examination is not to be minimized, the neurologic details are of less practical import than the physiologic responses to pressure. A hemiparesis or hemiplegia with slight or marked evidence of acute cerebral compression would, of course, direct one's attention to the portion of the brain affected, and in operation direct the approach.

Consideration of the selection of the comparatively small percentage of cases in which the indications for surgical relief seem beyond question bring up the pathologic conditions which we can relieve.

For practical purposes it is convenient to divide the pathologic conditions into:

(1) Brain injury with its contusions of varying degrees and locations, etc.

(2) Fluid accumulations within the skull.

These two conditions are, of course, frequently associated, but usually one outranks the other in the production of dangerous effects.

The first condition is a destructive one, and while we may offer some help surgically, our efforts are more often ineffective.

The second—fluid accumulations—gives us our greatest opportunity to afford relief.

As to the brain injuries, while varying greatly in degree and location, it is noteworthy that the greatest injuries are often near the region of the injury and at the opposite pole of the brain, and also irrespective of the site of injury to the head, the tips of the temporal lobes, and the under surface of the frontal lobes seem to be the places most subjective to contusion and laceration. Following brain contusion, swelling occurs as in other bruised parts. The work of Cannon seems conclusive that tissues contused and deprived of oxygen take up fluid. In this tissue edema it is to be kept in mind that the fluid is more or less fixed in the tissues. It is not free fluid.

The swelling of the brain: The brain edema will be greater or less, depending upon the factors producing it. If this swelling is moderate in degree it may be compatible with life. If great, the compression induced in the cranial chambers may be incompatible with the proper cerebral circulation, cause extreme intracranial pressure and death.

With such swollen and bruised tissue the relief of intracranial pressure by any decompressive operation to allow room for expansion is not very satisfactory. While some additional space may be given for expansion, one is impressed with the ineffectiveness and inadequacy of the operation. To give relief from pressure in true traumatic brain swelling the factors causing it must be removed. This is not usually within our power. It is possible that in a rare instance perhaps one might happen upon a badly contused and pulped temporal lobe. The washing out of clots and devitalized tissue would seem a proper procedure and be helpful. Such cases would be rare.

It seems a fair statement that to be of help in relieving intracranial pressure after head injury, something must be removed from the intracranial cavity, namely, some fluid accumulation.

Of the fluid accumulations within the skull it seems hardly necessary to mention extradural hemorrhages. The classical picture of primary unconsciousness followed by consciousness and then deepening stupor perhaps with hemiplegia has been often quoted, but the extradural hemorrhages unfortunately are not always aware of the rule and are not so obliging as to be invariably typical. However, the signs of an intracranial pressure increasing with often a hemiparesis and perhaps clinical or *x*-ray evidence of fracture in the temporal fossa give us a clue. Extradural hemorrhages too are not infrequently elsewhere than in the region of the middle meningeal artery or near its bifurcation. The aim of treatment of such a condition is obvious—to evacuate the clots and stop further hemorrhage. With free bleeding inside the dura, however, one is not usually so fortunate as to find the bleeding point, but evacuation of any free blood and drainage for a limited time can be practised.

As to the other fluid accumulations, much has been written of arachnitis or serous arachnitis, implying a formation of fluid due to an inflammation of the arachnoid, and this name has been used to cover certain accumulations of intracranial fluid. We have not seen, or at least have not recognized, this condition. There is no reason why inflammation should not follow injury in the course of wound repair; it is to be expected, and certainly leptomeningitis in various forms and from various agents is common enough.

There is, however, a condition which to our knowledge has not appeared in the surgical writing on head injury, nor been mentioned by surgical observers, namely, collections of fluid between the dura and the arachnoid.

It must have occurred to all who have operated upon any considerable number of persons with head injuries that an operation has been conducted in the presence of signs of marked pressure. In a certain group the dura is found tense and, obviously, the intradural tension is increased.

When the dura is nicked there is a spurt of fluid oftentimes to a considerable height, and it escapes in great amount. This fluid is often water clear, but at times may be blood tinged. With this escape the intradural pressure lessens rapidly.

When the dura is opened widely and a brain spoon inserted between it and the arachnoid it is found that there is still more free fluid in this space. This may be present in all directions from the subtemporal decompression opening—over the parietal, frontal, and occipital lobes as well as over the temporal. Following its evacuation it will be noted that there is also much subarachnoid fluid and that the arachnoid spaces sweat unusually freely. In an uncomplicated case the brain will show no visible evidence of contusion. It will be entirely normal in appearance. The free fluid evacuated has been collected and shows the usual chemical and microscopic findings of normal cerebrospinal fluid. Drainage of this free fluid rapidly lessens the intracranial pressure.

The important point in this group is that this free fluid which is apparently normal cerebrospinal fluid is *in an abnormal location.* Normally there is no fluid between the dura and the arachnoid. In the circulation of the fluid from the ventricles it passes through the foramina of Magendie and Luschka in the pial roof of the fourth ventricle, and from there on it remains beneath the arachnoid, between it and the pia, and circulates through the basal cisterns, and on.

From these larger cisterns it circulates over the various surfaces of the brain and to the final points of absorption. In these cases of head injury, on the other hand, we find this fluid increased in the subarachnoid spaces as shown by the free sweating of the cortex, but, in addition, we find these enormous collections of subdural fluid often to the amount of 2 or 3 ounces.

The reason for the appearance of this fluid in such a place is not clear. It seems likely, of course, that it is due to ruptures in the delicate arachnoid which permit its escape. We have found nothing to indicate that this fluid can be due to a serous arachnitis, for when it is examined it has been either apparently normal fluid or else with some admixture of fresh or old blood. These subdural collections are common and are readily relieved by drainage.

Such a free fluid collection is not, of course, in any way to be confused with a true brain edema when the fluid is more or less fixed in the tissue. We have not seen these free subdural fluid collections in any other than acute traumatic brains. They are not found in intracranial pressure from brain tumors or abscesses. This group condition may be found in association with some degree of visible brain contusion, such as small petechial hemorrhages beneath the pia or with greater degrees of brain injury, but is frequently found without any other discernible pathology. It yields most satisfactory results after treatment by drainage.

Of the other free fluid collections, bleeding may, of course, be found intradurally or occasional clots over the cortex. In the more exceptional instances one may find a deep intracerebral hemorrhage as in one of our recent cases. A left-sided hemiplegia with marked pressure symptoms was found to be due to a hemorrhage of about 3 ounces deep in the right temporal lobe. Its recognition after puncture with a brain cannula and its evacuation were not difficult.

It is in the case of subdural fluid collection, the extradural hemorrhages, and the occasional hemorrhage on the surface or deep in the brain that the surgical results are most satisfactory. In the diffuse brain contusions with true edema, although some benefit may be derived from decompression, the measure of relief is not great.

Much has been written and said of the value of decompression after head injuries. Relief of pressure is in certain instances a life-saving procedure, and in many others materially lessens the mortality. There is also some evidence to indicate that the high mortality after head injury is less in the operated cases. It is our experience, however, that the cases in whom operative treatment is indicated is less than 20 per cent.

In the decompression for brain tumor a large opening is desirable. In decompression for the cases under discussion the operation is one for drainage and a large bone opening is unnecessary. The cases we can help materially are those in whom something can be removed, namely, fluid, whether it be blood or the subdural collections mentioned. Removal of these fluids at operation with drainage for forty-eight hours is the rule.

The bone opening need only be so large as to permit satisfactory exploration in all directions. The operation of Cushing for subtemporal decompression is particularly adapted to these cases and may even be said to have its greatest usefulness in traumatic cases. In cases with a general increase in intracranial pressure a right-sided operation is performed. In cases with general pressure and some localizing signs, such as a hemiparesis or hemiplegia, it is performed on the side of the brain involved. In occasional instances bilateral decompression is used. In this operation the temporal muscle and fascia covers the site of the craniotomy. These structures not only afford protection and restraint to brain which may tend to herniate but also present a free yet protective barrier for the drainage channel. The raw surface of muscle which comes to lie against the exposed brain presents for a few days an area of great absorptive power—a factor in taking up excess fluid. The muscle and fascia give adequate protection to the area under the bone defect. No noticeable deformity remains. The site of operation also is such that the points of probable extradural hemorrhage are encountered. The middle meningeal artery and its branches can be controlled. The temporal lobe, so frequently the site of greatest damage, is exposed. From this opening, too, exploration can be conducted upward with proper instruments toward the motor cortex and toward the poles of the brain.

Some comment should be made as to other methods of removing fluid from the cranial cavity for the relief of pressure. Spinal puncture is of value in demonstrating free bleeding into the subarachnoid spaces. It is of value in tiding over and symptomatically relieving certain borderline cases. It is, of course, valueless in case of extradural bleeding.

In the subdural (extra-arachnoid) collections of fluid mentioned spinal puncture will symptomatically relieve. This procedure, however, withdraws subarachnoid fluid rather than the fluid, which is extra-arachnoid, and rapid return of pressure and reaccumulation of fluid is shown by large amounts of fluid on the next puncture. In such an instance drainage by operation is indicated. It is our feeling that in the face of rapidly advancing signs of pressure spinal puncture is inadequate.

The use of hypertonic solutions which have been shown by Weed, Wegefarth, and their associates to decrease brain volume and lessen intracranial pressure under certain conditions has been tried. In the comparatively few instances in which we have used it in traumatic cases it has been of no demonstrable benefit. It deserves, however, further trial, since it unquestionably has a marked though temporary affect in certain of the chronic brain compressions.

It is our feeling that decompression and drainage is of great value in properly selected cases. Their number is not great. Drainage is the important factor. The group characterized by collections of great quantities of fluid immediately beneath the dura and by a damming back of subarachnoid fluid, as shown by the great sweating of these spaces when pressure is relieved from without, is one to be compared with extradural hemorrhage in the satisfactory way in which it responds to treatment.

CLINIC OF DR. WALTER I. BALDWIN

University of California Medical School, Department of Orthopedic Surgery

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TECHNIC OF KNEE EXCISION AND BONE SUTURE

The time required to secure bony union after operations for knee excision in joint disease or extensive injury has often impressed us as being perhaps unnecessarily long.

Furthermore, we have noted that a certain proportion of these operations do not result in bony union, a short fibrous union resulting instead. These are the cases which result in late flexion deformity—fortunately, not common. Fibrous unions, however, do not give the strong walking legs which know no fatigue.

These facts led us to suspect that there might be some fault in the method. Briefly, this consisted of sawing off the surfaces of the tibia and femur to be rid of joint cartilage and then suturing the joint capsule, occasionally supplementing it with a deep bone suture of kangaroo tendon or silver wire. Subsequent *x*-rays taken in two planes often revealed the fact that there was shearing of the cut bone surfaces away from accurate contact in one plane or the other. This loss of accurate contact occurred at some time intervening between the wound closure and the application of the splint—usually during the hardening of the plaster cast. In fact, this often occurred even when the greatest care was taken to prevent any movement between the tibia and femur. The area of contact between these bones would be small instead of over the whole cut surfaces. In general, we found that these cases were delayed in time of union and were more liable to result in merely fibrous ankylosis.

This latter condition seemed to us traceable to blood collecting between the unopposed bony surfaces, with subsequent organization of the clot and ingrowth of fibrous tissue cells from the outside, thus forming a barrier through which osteoblasts could not make their way.

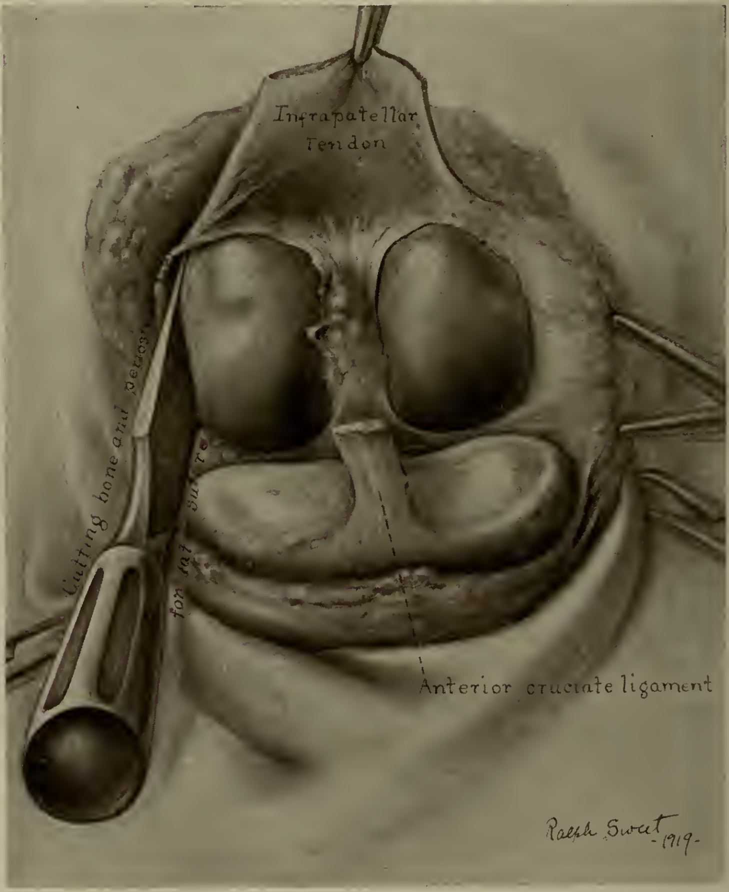

Fig. 307.—Cutting bone and periosteal flaps from sides and anterior aspects of condyles of femur and tibia.

We assumed also that sawing of the bone surfaces might leave bone dust behind, fill the bone spaces, and impede the establishment of circulation across the defect. For this reason we used a broad flat osteotome to remove the joint surfaces instead of a saw.

The method of internal fixation seemed by all means the most important question. In view of the fact in our bone-grafting experience periosteal callus was thrown out more readily than that from the cortical or endosteal areas, it seemed most important to secure accurate apposition by osteoperiosteal flaps from the tibia and the femur. The fact that they can be easily secured on the anterior and lateral aspects of both bones further recommended them. The suture of these flaps seemed mechanically easier and more exact than the placement of deep sutures, and afforded far better fixation. Furthermore, their suture presented a barrier to ingrowth of fibroblastic cells from at least the anterior and two lateral aspects of the knee. Splendid experimental work of Cowan, of Stanford University Medical School, on fractures of the patella bears out these clinical observations.

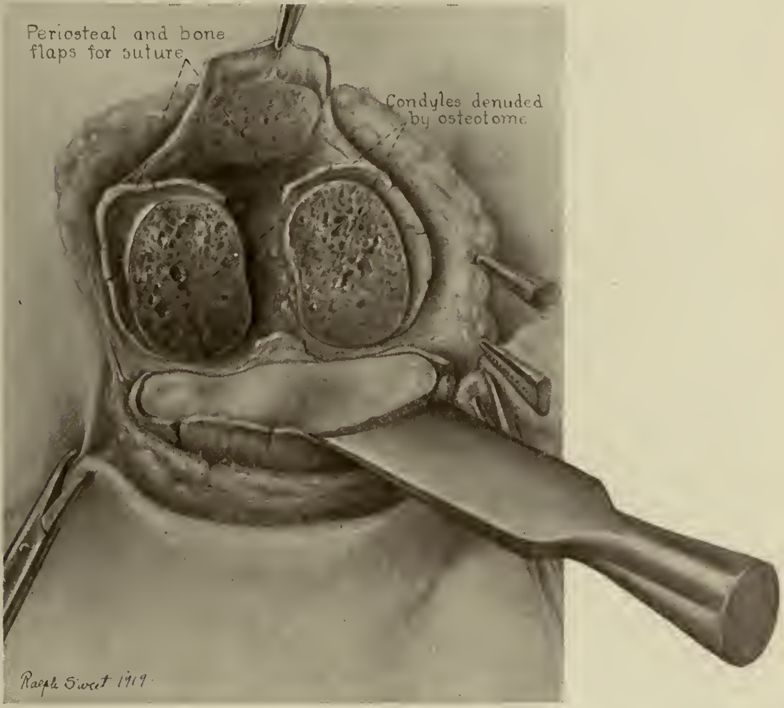
Periosteal and bone flaps for suture
Condyles denuded by osteotome
Ralph Sweet 1919

Fig. 308.—Removal of articular surfaces with osteome instead of saw.

We found that the suture of these thin osteoperiosteal flaps (with the patella countersunk) gave a surprisingly good fixation of the bones, so that a long plaster-of-Paris spica could be applied without fear of displacement of the more or less accurately apposed bone ends.

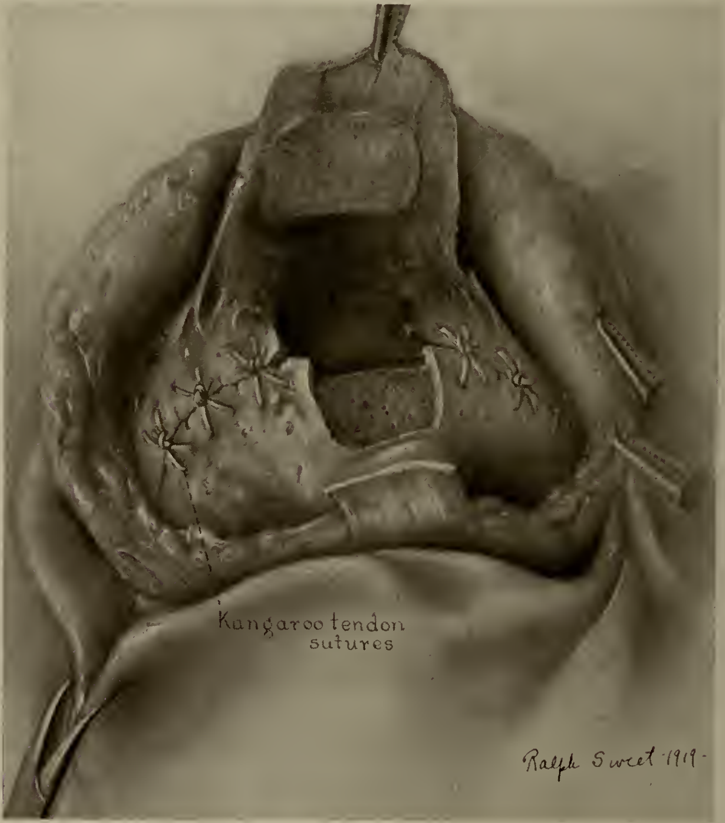

Fig. 309.—Suture of bones completed with patella ready to be placed across tibiofemoral line. Knee in 25 degrees of flexion.

It is our impression that the time of union has been reduced, but this statement should not be made until statistics of accurate observations are submitted.

It should be recorded, however, that the method allowed successful excision with later bony union in a child of eight years, where but one femoral condyle remained after the other had been removed for disease by a surgeon elsewhere.

We follow Brackett's advice of fixation in the flexed position, feeling that it gives far better function than in the extended position.

Figures 307–309 illustrate the operation in its various stages.

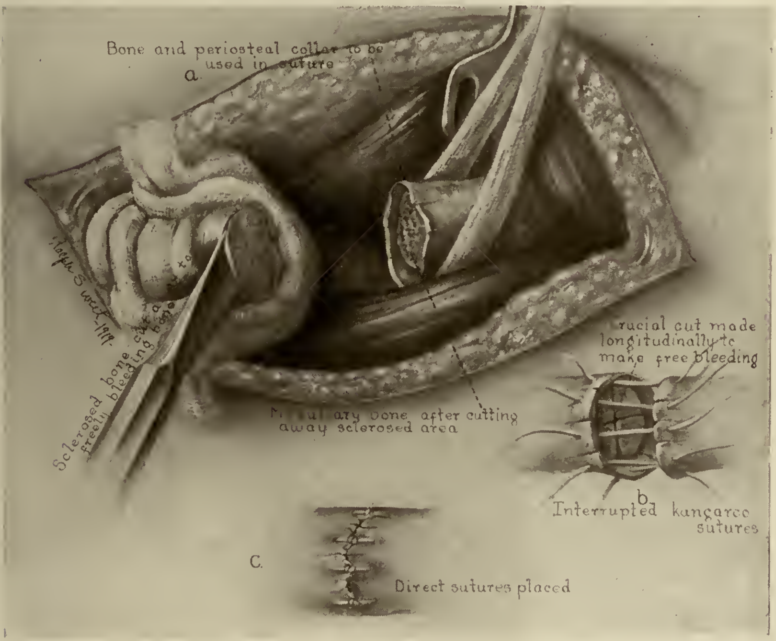
Bone and periosteal collar to be used in suture
a
Sclerosed bone cut away to freely bleeding bone
Medullary bone after cutting away sclerosed area
Crucial cut made longitudinally to make free bleeding
b
Interrupted kangaroo sutures
c
Direct sutures placed

Fig. 310.—Direct suture of non-union of humerus.

Direct Bone Suture.—Through war experience with non-union in single bones, particularly the humerus, we have come to strongly advocate direct bone suture by the osteoperiosteal "collar method." The direct suture method offers far better hope of success than can the more precarious method of bone-graft. Important also is the fact that it greatly shortens the period of disability.

The method is illustrated in Fig. 310.

The operation is followed immediately by the application of a plaster-of-Paris shoulder spica to the hand and around the body. The cast is continued until such time as union is firm, no other splint being permitted.

CLINIC OF DR. FRANK HINMAN

UNIVERSITY OF CALIFORNIA HOSPITAL

THE STANDARDIZATION OF PROSTATECTOMY WITH REFERENCE TO THE RECENT MODIFICATIONS OF YOUNG'S TECHNIC

THE history of prostatectomy presents many controversies, not all of which are settled. Probably no surgical field can show such prolonged active dissension over technical methods for the treatment of the same condition. The differences under dispute would seem to cover only insignificant and minor details, but the immediate and distant effects of these details have been held and usually proved to be of vital significance.

Two standard methods of surgical attack have survived—the suprapubic and the perineal. Each has passed through its own period of development, but neither can be pronounced as perfect. The Fuller-Freyer technic stands out, with slight modifications in different hands, as the standard method of the one route, and Young's technic, modified as to some details also, as of the other.

The overwhelming popularity of the one over the other is due to the growing conviction that subrapubic removal is technically easier, and that the functional result, therefore, is more certain to be satisfactory because of the more certain absence of any surgical defect. The technical difficulties of perineal removal account for its general disfavor, although for a number of years it had considerable vogue in America, due, no doubt, to the unusual success of Dr. Young with it. The perineal route is even now universally recognized as the more benign of the two methods, and when performed successfully and correctly, so as to give as good or better functional result, it is undoubtedly the method of choice for this one reason.

The technical difficulties of perineal prostatectomy consist primarily in keeping out of the rectum, in preserving the external sphincter from injury, as a direct effect of surgery or an indirect one of adhesions or scar, and in protecting the ejaculatory ducts from destruction and occlusion; and secondarily, in securing a clean, complete removal of the obstructing prostate in such a manner as to prevent a recurrence, and at the same time to leave no structural defect. These difficulties are all not strictly confined to the perineal route. The rectum and the external sphincter are peculiarly partisan, but suprapubists injure the ejaculatory duct, incompletely remove the obstruction, and sometimes leave pronounced structural defects, besides other difficulties peculiar to the suprapubic route. But undoubtedly rectal fistulæ and incontinence as surgical sequelæ of perineal operations account for the almost universal adoption throughout the world of the suprapubic method of prostatectomy. Surgeons inexperienced in perineal prostatectomy prefer subjecting their patient to the somewhat greater surgical risk of suprapubic removal in order to lower the risk of functional failure later. However, the late results even after suprapubic removal are not altogether and always satisfactory. Personally I have seen more complete functional failures secondary to suprapubic than to perineal removal. You might infer that my own failures, inasmuch as I prefer the perineal route, have gone elsewhere for correction, but careful complete follow-up records disproves this explanation. The point I wish to make is that suprapubists are not justified to regard their results so superior, and certainly in no way perfect or completely satisfactory. Even suprapubic prostatectomy requires better standardization and considerable technical improvement.

Proof of the thoroughness of Young's technic is found in the fact that it has stood almost twenty years without modification, and the future alone can answer whether the slight changes recently advocated both by Dr. Young and several of his pupils will improve the results over those of the standard method. In

December, 1921 were published, in detail, personal results with perineal and suprapubic prostatectomy,[1] and at the same time there was presented a slight modification in perineal technic, used in the last 25 cases of the report, of a radical *en masse* enucleation.[2] Analysis of my own mistakes on all perineal cases up to this time showed that the most costly had been the "complications arising from urinary infection, and the defects in structure that had resulted from an incomplete enucleation of the gland at the time of the operation." I had gotten into the rectum only once in 90 operations, and the opening had closed spontaneously before the patient left the hospital, so that I did not regard the danger of rectal injury as a serious difficulty. There was one case of partial incontinence, a case, however, which had had an incomplete suprapubic operation previously. Only 7, including the case of partial incontinence, of these 88 initial perineal operations (2 surgical deaths) failed to get complete relief and satisfaction. Up to the time of this analysis 81 consecutive cases had weathered perineal operation without a death, and there was a total surgical mortality for all cases of only 2.2 per cent.

It will not be possible in any large general series to expect, by whatever method, a 100 per cent. complete cure. Certain cases present clinical or urologic complications which prostatectomy may neither benefit nor cure. These tentative failures can usually be recognized beforehand, and should be, so that they may have proper care subsequently. The above analysis, however, served to emphasize two difficulties which presented themselves to me personally in the successful performance of perineal prostatectomy. One was the clean, complete enucleation of the hyperplasia, and the other was perfect preservation from injury of the external sphincter. The standard technic of Young has been slightly modified during the last few years with the idea that in so doing these two difficulties might be more easily surmounted. Radical *en masse* enucleation has been practised in order to secure completeness, and, in the last 21 cases omission of the standard step of exposing and incising the membranous urethra, in order better to protect the external sphincter.

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[1] Suprapubic versus Perineal Prostatectomy. A Comparative Study of 90 Perineal and 38 Suprapubic Cases, Jour. of Urol., 1921, vi, 417.

[2] Structural Results of Prostatectomy with Reference to Methods of Enucleation, Archives of Surgery, 1922, iv, 154.

It would be wrong to leave the inference that these modifications are altogether original. For some time Chute[1] has practised perineal enucleation transprostatically and without opening the membranous urethra, with the view of better preservation of the external sphincter, and Geraghty[2] has clearly presented the anatomic and functional advantages of such a modification of Young's original technic. Cecil[3] and Crowell[4] have each presented modifications and special instruments of application, the former's being particularly commendable to those fearful of tearing into the rectum, and even Dr. Young[5] recently advocates certain changes whereby *en masse* enucleations will secure better structural results. All these modifications have seen the light of publication practically simultaneously (between December, 1921 and November, 1922), and although the changes in technic have been worked out more or less independently, they have this in common, that the attempt to make perineal prostatectomy functionally more secure and technically easier is obvious.

It will now be necessary for each one using a modified technic to keep accurate records of results in order again to standardize the method; for slight differences in detail may be responsible for marked differences in results. Dr. Young, for example, objects to the inverted V capsular technic of enucleation, which has the advantage of a wider and better visual exposure with a cleaner, more surgical result, because he has found that wound healing was slower, and occasionally a stricture formed at the anterior part of the prostatic urethra results, explainable by the triangular flap having been so turned backward as to leave a larger area to be filled in by granulation. By careful suture of

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[1] Discussion: Jour. Urol., 1921, vi, p. 482: "I have been in the habit of making use of a method that I think diminishes the possibility of impaired control following the perineal operations, this is to open the urethra by going through the tip of the prostate itself rather than anterior to it."

[2] A New Method of Perineal Prostatectomy which Insures More Perfect Functional Results, Jour. of Urol., 1922, vii, p. 339.

[3] A New Technic for Performing Perineal Prostatectomy, Jour. Amer. Med. Assoc., 1922, lxxii, 1661.

[4] Crowell and Thompson: Sacral Anesthesia in Perineal Prostatectomy. A Modification of Young's Operation with Summary of Cases, Jour. Urol., 1922, viii, 81.

[5] The Technic of Prostatectomy and its Relation to Mortality, Jour. Amer. Med. Assoc., 1922, lxxii, 933.

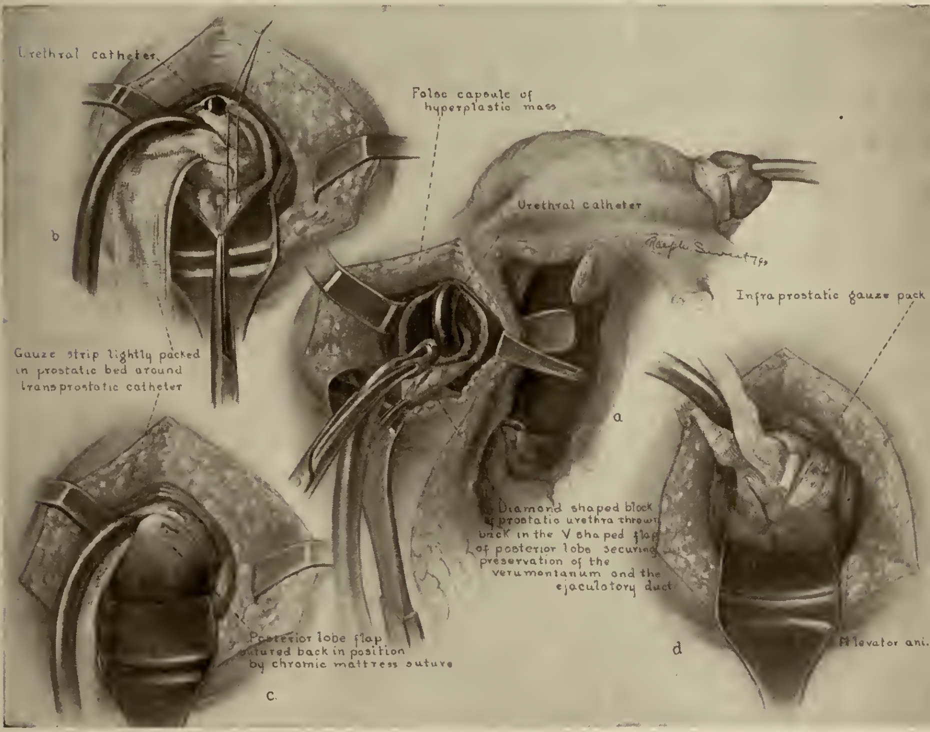
Urethral catheter
False capsule of hyperplastic mass
Urethral catheter
Ralph Sweet
Infraprostatic gauze pack
b
Gauze strip lightly packed in prostatic bed around transprostatic catheter
a
Diamond shaped block of prostatic urethra thrown back in the V shaped flap of posterior lobe securing preservation of the verumontanum and the ejaculatory duct
Posterior lobe flap sutured back in position by chromic mattress suture
c.
d
Levator ani.

Fig. 311.—Method of catheter drainage and packing: *a*, Urethral retention catheter is placed for vesical drainage and re-establishment of prostatic urethra. Perineal catheter is placed for drainage only. *b*, Light prostatic gauze pack in the prostatic bed for hemostasis. Removed in twenty-four hours. *c*, Closure of the prostatic flap by a mattress-suture on the left with gauze and perineal catheter issuing through right-sided slit. *d*, Placement of a large or small infraprostatic gauze pack which is removed one-half hour after the prostatic gauze is removed, provided there is no hemorrhage.

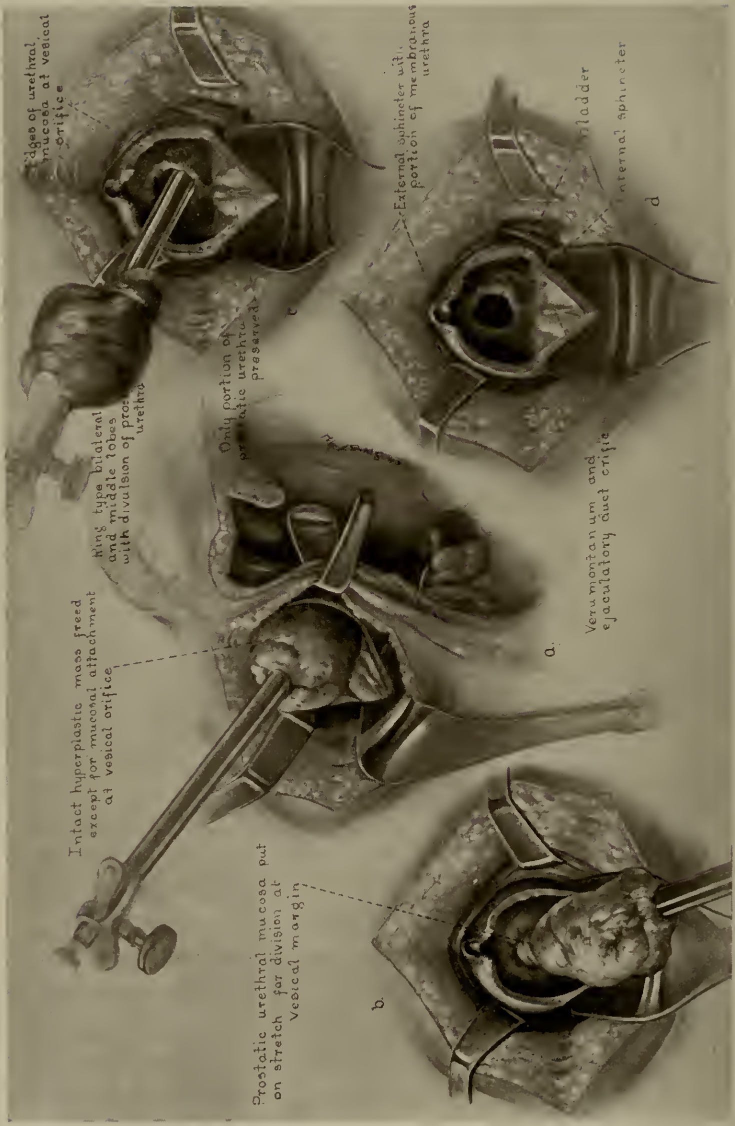
Prostatic urethral mucosa put on stretch for division at Vesical margin
Intact hyperplastic mass freed except for mucosal attachment at vesical orifice
b.
a.
Verumontanum and ejaculatory duct orifice
Ring type bilateral and middle lobes with divulsion of pros urethra
Only portion of prostatic urethra preserved
Edges of urethral mucosa at vesical orifice
c
External sphincter with portion of membranous urethra
bladder
Internal sphincter
d

Fig. 312.

the flap back in position on one side, and the use of a retention catheter so as to enable re-establishment of a prostatic urethra just as is done after external urethrotomy, we have, on on the contrary, materially shortened healing and closure of the perineum; in fact, 14 cases, or 21 per cent., never leaked through the perineum after withdrawal of the perineal tube, but we have had one stricture in a case in which a retention catheter was not successfully used. The slight difference in technic of use or not of a retention catheter after operation may, therefore, be responsible for a marked difference in the time and character of healing (*vide post*).

The slight variation in Young's technic that has been more or less uniformly used in the last 61 cases is as follows:

1. Young's seminal vesical tractor unopened has been used to replace the urethral sound as a guide to the apex of the prostate (in the last 21 cases).

2. When the apex is exposed the tractor is passed on into the bladder and opened for use in holding the prostate well up in the perineum, thus facilitating the exposure of its posterior surface by stripping back of the rectum. This obviates the need of opening the membranous urethra for the insertion of the prostatic tractor.

3. A wide curved incision is made in the posterior surface of the prostate and is deepened sufficiently to open thoroughly the prostatic urethra. The vera montanum and ejaculatory ducts are contained and preserved in this triangular flap.

Fig. 312.—Method of enucleation: *a*, The hyperplastic mass has been freed in its prostatic bed except for its mucosal attachment at the vesical end. *b*, The urethral mucosa put on a stretch at the vesical margin preparatory to its division with knife or scissors. *c*, Ring type hyperplastic mass slid out on tractor shaft after division of the mucosa as shown in *b*. The greater portion of the prostatic urethra has been removed with it. The ragged edges are seen at vesical margin. Internal sphincter has been surgically preserved. *d*, The structural result of perineal *en masse* enucleation. Prostatic urethra divulsed. Internal and external sphincters preserved. Ejaculatory ducts and verumontanum preserved. Healing is possible with almost or complete obliteration of the prostatic cavity, and for this healing the methods of drainage and of packing for hemastasis are important.

GROUP I

Case No.	Clinical risk.	Urologic risk.	Retention catheter for—	Dry with catheter after—	Perineum permanently closed.	Time of closure after removal of catheter.	Time in hospital, post-operative.	Time of preparation.	Total stay in hospital.	Remarks.
1	A	C	10	8	8	..	19			
2	C	B								
3	B	A	11	3	3	..	15			
4	A	A	12	6	16	4	22			
5	B	B	16	12	12	..	48	..	..	Epididymitis.
6	B	A	17	14	14	..	28	..	..	Carbuncle.
7	..	..	14	10	10	..	24			
8	A	B	14	3	3	..	21	..	..	Suprapubic cystotomy for stone prior to prostatectomy.
9	A	A	11	3	23	12	32			
10	B	A	N. S.	N. S.	16	..	19			
11	B	A	17	14	14	..	22	..	..	Epididymitis.
12	B	A	N. S.	15	15	..	25	..	..	Otitis media.
13	C	A	14	..	26	12	31	40	71	Nephritis with B. P., 215.
14	A	A	24	16	16	..	60	N. S.	..	Recto-urethral fistula closed spontaneously before leaving hospital.
15	B	A	16	10	10	..	25	8	33	Postoperative dementia.
16	A	A	20	20	25	5	43	8	51	Chill and pyelitis on twenty-fifth day.
17	A	A	5	..	30	25	56	9	65	Epididymitis eighteenth day. Left popliteal phlebitis.
18	C	B	N. S.	N. S.	..	N. S.	45	79	124	Preparatory cystotomy for seventy-one days. Epididymitis. Severe nephritis and pyuria.
19	A	A	14	2	2	..	28	24	52	Hemorrhage per urethra after removal of catheter.
20	B	B	6	..	15	9	29	24	53	Phlebitis.
21	A	A	5	2	2	..	20	6	26	
22	A	A	26	5	5	..	39	14	53	Phlebitis.

23	A	A	4	22	22	18	24	18	42	
24	A	A	12	5	5	. .	20	12	32	
25	A	A	15	15	15	. .	20	13	33	
26	A	A	14	12	12	. .	23	10	33	
27	B	A	12	12	12	. .	16	7	23	
28	A	B	9	9	13	4	20	16	36	Preoperative epididymitis.
29	B	A	10	3	20	10	20	6	26	
30	C	B	14	10	10	. .	20	24	44	
31	A	A	6	6	24	18	35	7	42	Slight epididymitis postoperative. Anemia, bleeding for twelve days.
32	B	A	13	12	14	2	21	17	38	
33	A	A	11	. .	20	9	21	6	27	
34	B	A	8	. .	17	9	37	14	51	Hypertension and albuminuria.
35	A	A	8	5	5	. .	19	9	28	
36	B	B	13	Occasional leakage.	18	5	27	13	40	
37	C	C	6	. .	17	. .	26	29	55	Catheter replaced on fourteenth day; no leakage following second removal.
38	C	C	7	. .	14	7	15	56	71	
39	B	B	9	9	13	4	23	9	32	Postoperative dementia.
40	A	A	11	11	20	9	28	6	34	Epididymitis.
No. of cases.	*39* Poor, 6 Medium, 14 Good, 19 Total, 39	*39* Poor, 3 Medium, 9 Good, 27 Total, 39	*38*	*19*	*38*	*18*	*39*			
Average	. .	. .	9 days	9 days	14 days Longest, 30 days; shortest, 2 days; one perineal fistula.	9 days	27 days			
Percentage.	. .	. .	. .	51	. .	49				

Group II

Case No.	Clinical risk.	Urologic risk.	Retention catheter for—	Dry with catheter after—	Time of closure after removal of catheter.	Perineum permanently closed.	Time in hospital, post-operative.	Time of preparation.	Total stay in hospital.	Remarks.
1	A	A	5	..	10	15	27	9	36	Hemorrhage seventh day postoperative.
2	A	A	10	..	6	16	22	10	32	
3	A	A	13	10	..	10	21	12	33	
4	A	A	6	..	8	14	18	6	24	
5	B	A	7	..	8	15	14	17	31	
6	B	A	13	..	Replaced several times.	..	75	23	98	Recto-urethral fistula. Postoperative dementia.
7	A	A	8	3	6	14	22	8	30	
8	A	A	10	9	..	9	19	13	32	
9	A	A	7	..	16	23	28	10	38	Epidymitis eighth day.
10	B	B	15	13	..	13	19	26	45	
11	C	B	4	..	..	Left hospital with perineal fistula.	44	27	71	Diabetes, epididymitis.
12	A	A	12	..	9	21	35	10	45	
13	C	B	4	2	..	2	18	9	27	
14	A	A	11	9	..	..	66	7	73	Recto-urethral fistula.
15	B	A	10	7	..	7	16	18	34	Epididymitis, preoperative.
16	C	B	14	..	2	16	60	..	60	Diabetes.

17	A	A	17	3	. .	3	20	N. S.	20	
18	C	B	8	. .	26	34	In hospital at present 101	26	127	Postoperative, bronchopneumonia. Acute cholecystitis, fifty-eighth day. Perirectal abscess, ninety-fourth day.
19	B	A	8	. .	12	20	57	9	63	
20	B	A	5	. .	11	16	44	11	55	Epididymitis, preoperative. Dementia.
21	B	A	14	2	. .	2	21	14	35	
No. of cases	*21* Poor, 4 Medium, 7 Good, 10 — 21	*21* Poor, 0 Medium, 5 Good, 16 — 21	*21*	*9*	*11*	*18*				
Average	. .	. .	9.5 days	6 days	10 days	14 days	32 days			
Percentage	. .	. .	. .	43	57					

4. The vesicle tractor is withdrawn and the prostatic tractor, passed through the flap opening in the prostatic urethra into the bladder, substituted so as to get more direct and better controlled traction.

5. Complete *en masse* enucleation under visual control is practised.

6. Immediate visual correction of structural defects, such as tags or nodules and suture control of hemorrhage at the neck.

7. Placement of urethral retention catheter.

8. Mattress-suture of prostatic flap back in position on left side.

9. Perineal drainage-tube and gauze packing, prostatic and infraprostatic, with exit on right side.

The perineal and urethral catheters are irrigated just sufficiently to keep free drainage, which is encouraged by Connell suction. Usually all gauze and the perineal drain are withdrawn after twenty-four hours. The urethral catheter has been retained on an average of nine days, as long as twenty-six in one case, Connell suction being used continuously so as to keep the perineum dry, and bladder irrigations and urethral lavage used for proper hygiene of the bladder and urethra. The use of Connell suction is an important detail in the technic.

The accompanying tables give the time of perineal closure, and it is seen that 19 cases in Group I and 9 in Group II, or almost 50 per cent., had permanent healing of the perineum during the period of postoperative catheter drainage. In other words, 28 cases had no urinary leakage through the perineum after removal of the catheter, giving an average for permanent closure of the perineum of nine days, and, as already stated, 14 of these 28 cases practically enjoyed *per primam* healing. The 18 cases of Group I and the 11 cases of Group II which leaked through the perineum after removal of the urethral catheter had closed permanently on an average of ten days later, the shortest postcatheter period of closure being two days, and the longest twenty-six days. As a rule this postcatheter leakage in these 29 cases was through a pinpoint fistula and consisted in the occasional escape of a few drops of urine.

The average time of permanent closure of the perineal fistula after operation for all cases (except Case 11) is fourteen days, the shortest two days, and the longest thirty days. Case 11 was a diabetic, very obese, with advanced cardiorenal complication, a very poor clinical risk. His urethral catheter came out, probably pulled out, on the fourth day, and was not replaced. He had a postoperative bronchopneumonia, and because of family reasons was allowed to be taken from the hospital on the forty-fourth day with persisting perineal fistula. He was returned three months later about as on discharge, and a deep urethral stricture found. Before this could be satisfactorily dilated he suffered an acute gastric upset, with gastric dilatation and cardiac failure.

It is difficult to find statistics for comparison. In our own first series of 90 cases (no cancer cases) by Young's standard method[1] the average time of perineal closure was twenty days, shortest two days, longest one hundred days; and there were no cases of permanent fistulæ. In Young's "Study of 145 Cases of Perineal Prostatectomy,"[2] unexcelled for completeness, is given the following table showing time of closure:

4 cases between 5 and 9 days.
21 cases between 10 and 14 days.
31 cases between 15 and 19 days.
17 cases between 20 and 24 days.
7 cases between 25 and 29 days.
7 cases between 30 and 34 days.
3 cases between 35 and 39 days.
6 cases between 40 and 49 days.
1 case between 50 and 59 days.
13 cases over 60 days.
17 cases of fistula closed, but time not stated.
6 cases still open (2 recent).
10 cases died before closure of fistula.
2 cases operated during the past three weeks.

Closure practically *per primam* in 14 cases of our last 61 cases, and in fourteen days on an average for all, is seen by comparison to be a decided improvement, and stands as a recommendation for postoperative catheter drainage, and as evidence that the wide inverted V incision for enucleation does not delay perineal closure.

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[1] Suprapubic or Perineal Prostatectomy, Jour. of Urol., 1921, vi, 417.

[2] Johns Hopkins Hospital Report, vol. xiv, p. 99.

Analysis of results as to functional restoration by the modified technic in Group II will not now be given, as the period since operation is insufficient. Our impression is that they are satisfactory. An analysis already made of Group I is highly so.[1] A glance at the table, however, shows two recto-urethral fistulæ (Cases 6 and 14). We have found anatomic dissection somewhat more difficult than when Young's standard method is used. Greater familiarity will probably correct this. Young had 7 in his first 145 cases which he attributed to failure of approximation of the levator ani. It is possible that the infraprostatic pack has been a factor in the rectal injury of these 2 cases.

[1] Archives of Surgery, 1922, iv, 154–174.

CLINIC OF DR. HANS BARKAN

Stanford University Hospital

EYE CLINIC. DEMONSTRATION OF FOUR CASES

The first patient I am presenting is a young man with double-sided keratoconus. These congenital anomalies are rather rare. The patients may show other congenital anomalies, such as microcornea, retinitis pigmentosa, and atrophy of the optic nerve. As a rule the disturbance in the vision progresses slowly at about the age of puberty, and, as a rule, equally so on both eyes. The astigmatism caused by this conical projection of the cornea can at first be corrected with glasses, but usually the projection advances to such a degree that an operative interference, the aim of which is to produce a flatter cornea, is called for. The first recognition of this condition may be made by observing the reflex on the cornea of a placido's disk, the rings of which will appear distorted. The advance of the keratoconus may be rapid. As a rule, however, it reaches its maximum point four to five years after the disturbed vision first noticed by the patient has brought him to us for diagnosis (Fig. 313). When one looks carefully at this patient, and in similar cases that I have seen, it is to be observed that he shows a rather delicate physical build, is nervous, pale complexion, dry skin, states that he seldom perspires freely, and that his hair is apt to fall out readily. The blood-picture shows a relative increase in the lymphocytes and a marked increase in eosinophil cells. In these days of interest in internal secretions it has been natural to place these patients in some relation to internal secretory disturbance, and on the part of some authorities the whole picture of keratoconus has been put in the group of hypothyroid disturbance. From the standpoint of treatment this is immaterial, and we will proceed to a discussion of "what are we going to do?" This boy's vision has dropped to counting fingers in 6 feet on both eyes. He is unable to earn his living, and is willing to put up with a long period of treatment provided we can get him a workable amount of sight. In his case I shall proceed to do the operation which finds most appeal over a period of years, although some more recently advocated procedures of Webster Fox, of Philadelphia, may supercede the old method. With a glowing cautery I proceed to draw a line, starting in the vertical meridian of the cornea, still in the limbus, and following the vertical meridian through the cornea to the apex of the keratoconus, burning deeply, but not perforating until the apex of the keratoconus is reached. Here I perforate, the aqueous escaping. You will notice that eserin has first been given in order to make the pupil as small as possible, so that upon perforation of the cornea injury to the lens may be avoided. A pressure bandage is now used. No bandage can exert real pressure for any great length of time without being too painful. We lay a sponge upon the eye and then bandage over to give uniform pressure which can be easily released or decreased by drawing the bandage tighter

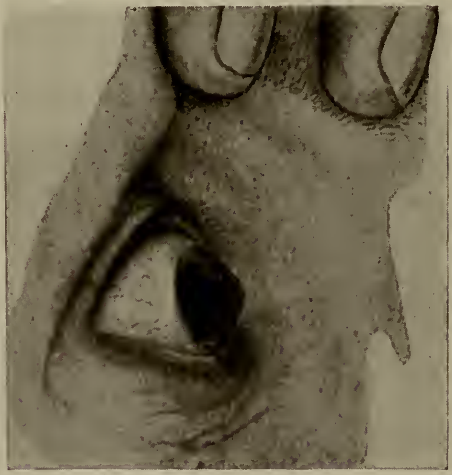

Fig. 313.

or loosening it somewhat. The same procedure will be done on the other eye tomorrow. I never operate upon both eyes at one sitting no matter what eye condition may be involved. It is not good surgery, for a possible infection may lose both eyes instead of risking one only. The patient will keep to his bed for several days and will keep the pressure bandage on for two to three weeks, and move about as little as feasible. At the end of this time the cornea will be fairly flat and marked with a gray scar in its perpendicular meridian running from the limbus to almost the corneal center. If this scar interferes with the pupillary opening an optical iridectomy down and in will be performed. It is usually necessary to do an optical iridectomy. Vision with properly correcting glasses may range from 3/10 to 5/10, enough for the reading of coarse print. Operations such as trephining into the anterior chamber with iridectomy have been tried, but I do not favor them.

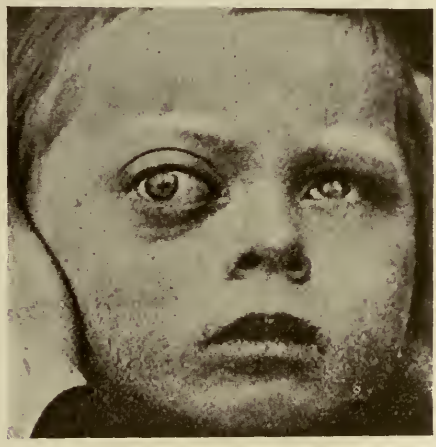

Fig. 314.

This child is the next case (Fig. 314). You see the protruding right eye shoved almost out from between the lids somewhat down and out. You note the absence of all inflammatory signs. There is no edema and no redness. We can safely eliminate as cause a periostitis or a subperiosteal abscess. The blood examination has given no indication of a leukemia or a pseudoleukemia. Nodules of this character then lying behind the eye may be excluded. The Wassermann is negative; the child's parents healthy and there are no stigmata of congenital lues; a gumma may be excluded. Examination of its sinuses fails to show any abscesses which may have broken into the orbital cavity. There is no necrosis of bone and no fistula, and with a general healthy condition in the child a tuberculous process scarcely comes into question. We are almost, by exclusion, led to the diagnosis of retro-orbital sarcoma. The eye is blind, and though at present of only cosmetic inconvenience, will soon be shoved beyond the limits of protection on the part of the lids; the cornea will become necrotic and the eye will be lost. In palpating this eye we find that it cannot be shoved backward and not moved even in the direction upward and in-

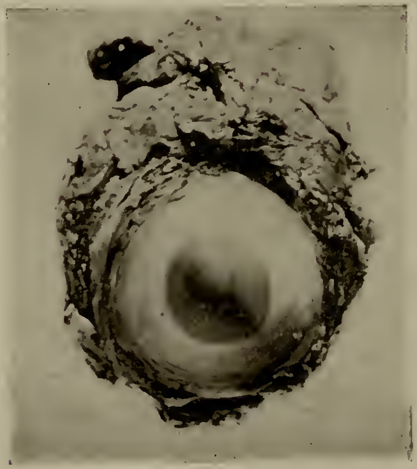

Fig. 315.—Specimen consists of an eye which superficially appears normal anteriorly. On one side, beginning about 5 mm. beyond the corneoscleral juncture, is an irregularly lobulated orbital encapsulated uniform mass of tissue measuring 2.7 by 2.5 cm. This mass has been incised. The cut surface presents a fine granular stippling, is for the most part translucent, with but small more translucent grayish areas seen, as if possibly myxomatous and edematous. Bisection of the orbit showed no internal anomaly. Photographs were taken of the specimen as a whole and after bisection, which included the eyeball.

ward. Ophthalmoscopic examination has shown an atrophic optic nerve. The protrusion has existed, according to the history, for six months, and was supposed to have first been noted following a paroxysm of whooping-cough. It is, of course, possible that hemorrhage into the tumor mass took place at that time, and that a rather sudden marked protrusion did occur. As this eye is blind and as the tumor is, from all the points in the history, a rapidly growing one, a total removal of eye and orbital contents is indicated. We will proceed to the same. I cut through the external palpebral commissure so as to give a little room, and elevating the upper lid cut upward and through the conjunctiva to the periosteum and through it all along the supra-orbital ridge. I repeat the same incision along

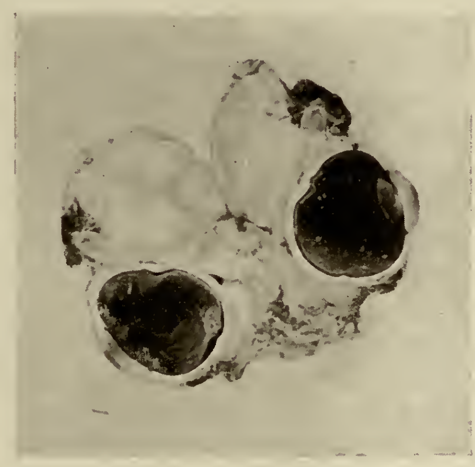

Fig. 316.—Microscopic examination of the growth shows it to be distinct from the sclera in the region examined and also does not involve the mass of muscle adjacent to it. This muscle, however, presents a certain amount of fibrosis. The growth proper is of connective-tissue type, is divided into irregular compartments by bands of more fibrous, less cellular connective tissue. These included masses are composed of connective-tissue cells, more or less separated as if by edema, giving a stellate appearance in places. In other regions they are arranged more regularly in loose strands. The protoplasm at times shows vacuolization, the nuclei are relatively large, the chromatic material is moderate in amount. Mitotic figures are fairly numerous and atypical mitoses are occasionally observed. Diagnosis: Fibrosarcoma.

the infra-orbital ridge, join the two at the lid margin, and introduce the periosteal elevator. With this I go all around the wall of the orbital cavity going further and further back, with my assistant pulling this cone of eye orbital tissues and periosteum forward. Having at length, accompanied by a good deal of hemorrhage, reached the apex of the orbital cavity, a stout slightly curved scissors is introduced, and the apex of this cone cut off in the depths of the orbital cavity. Profuse bleeding takes place from the many fine emissary periosteal veins, and repeated fine cauterizations with a glowing cautery are made until the main seepage is stopped. The cavity is now tightly packed with iodoform gauze and a bandage applied (Figs. 315, 316). The microscopic examination of this tumor mass will follow as a matter of routine. As it seems thoroughly encapsulated, it is probably a fibrosarcoma arising from the fascias or sheaths of the ocular muscles, and the chances are good that the child will not hear from it again. Granulations will spring up quickly, filling the socket; the lids be drawn in with the cilia turned toward the granulating masses, and it is best to perform a Thiersch graft later, joining the lids, their edges containing the cilia first having been snipped off. It will not be a pretty child and there is apt to be partial atrophy of that side of the face later.

The next case is one of intra-ocular foreign body. This man was struck on the eye by a bit of steel while hammering on a chisel. A sharp pain occurred, but no very great loss of vision. It is now two weeks since the injury. The sooner the foreign body is localized and extracted, the less the chance for infection and for the deleterious effects of chemical decomposition products of the foreign body. The external evidences of injury are only a slight laceration of the cornea at just the temporal side of the pupil; a clean perforation through the iris showing as a pitch-black triangle, a somewhat dilated pupil reacting slowly to light, and that is all. Fundus examination showed a few vitreous opacities; a few small floating blood-clots and a haze in the vitreous far back and to the temporal side, where the piece is probably located. This localizing chart shows within a practically negligible amount of error the exact location and size of the piece. To have this exact information is of tremendous value (Fig. 317). The Sweet apparatus, invented by Dr. William Sweet, of Philadelphia, does this work admirably Every roentgenologist should be able to use it, and can with a little practice. You see that the piece is described as being 2 x 1 x 1.5 mm. in size; that its density is that of some metal,

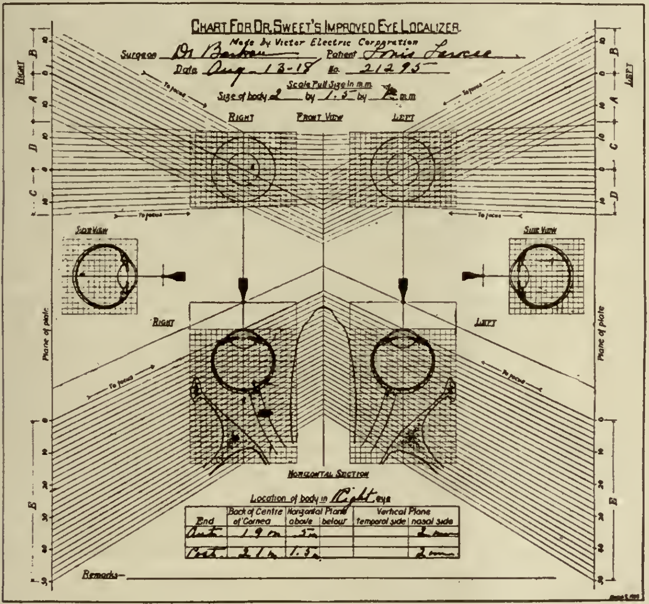

CHART FOR DR. SWEET'S IMPROVED EYE LOCALIZER

Made by Victor Electric Corporation

Surgeon Dr Barkan Patient Louis [illegible]

Date Aug 13-18 No. 21295

Scale Full Size in m.m.

Size of body 2 by 1.5 by [illegible] m.m.

Location of body in Right eye

End	Back of Centre of Cornea	Horizontal Plane above	Horizontal Plane below	Vertical Plane temporal side	Vertical Plane nasal side
Ant.	19 m	5 m			2 mm
Post.	21 m	1.5 m			2 mm

Remarks—

Fig. 317.—Foreign body had been in eye two weeks; was removed by magnet through scleral incision. Magnet points put in over spot of localization.

such as iron, steel, or copper, and that it is located 19 mm. in back of the cornea, 2 mm. to the nasal side of the midline of the eye, and 5 mm. above the horizontal plane. From the history of his employment we can safely assume that it is a metal possessing magnetic qualities, and proceed to extract it with the giant magnet. The choice of routes of approach presents itself. Shall we attempt to pull it out along its road of ingress, or shall we make an opening into the eyeball as near to the piece as possible and extract it in this fashion? As the anterior portion of the eye has been damaged very little, and as his vision is still 5/10, I hesitate to pull the piece along the same road. It may cause a good deal of damage in the regions of the ciliary body, iris, and lens, and being small and far back, may not appear at all. I therefore, under general anesthesia, proceed to roll the patient's eye nasally as far as possible, and have it fixed there by my assistant. I split the external canthus with a pair of scissors, and as the lids are spread as far apart as possible by a stout speculum there is very little bleeding from this area. I now cut through the conjunctiva and Tenon's capsule just below the inferior border of the external rectus muscle and as far back as possible, exposing the sclera. One suture pulls the conjunctiva up; another pulls the conjunctiva away from below. I incise the sclera with a cataract knife, making an incision at least twice the size of the piece to be removed. You will notice that the giant magnet is in position and its point within a few inches of the incision before I incise. The nurse is ready to lower the magnet down to the lips of the wound the moment I give the word. I incise; the magnet is quickly lowered a few inches until its tip touches the wound margins, and the current applied full force. The piece hops into the wound; the magnet is raised, the sutures holding the conjunctiva let go of and quickly tied together. There has been practically no loss of vitreous. All extractions are not as smooth as this one by any means, but the principle of proceeding remains about the same.

This last case is one of chronic simple glaucoma, the bugbear of ophthalmalogists since the time of Hippocrates. The classical iridectomy of von Graefe has helped us at least in part to stay the progress of this malignant, slowly progressive disease of the eye. It is just, however, in this chronic non-inflammatory type that the iridectomy seems to be of the least advantage. In order to reduce the tension of the eyeball—the tension while not the cause of the disease, being the factor, which, by its pressure on the optic nerve, causes the loss of vision—I proceed to do an Elliott trephine (Fig. 318). This operation consists of making a conjunctival flap at the upper limbus, exposing the sclera, and even a small rim of the cornea. This small 1 mm. trephine is placed so as to include both sclera and cornea, and with a few rapid turns a button is drilled out of the sclera and cornea. The operator knows when he is through, for the patient at that moment winces slightly and one sees the pupil draw upward. The trephine removed, the button swings upward like a trap-door, and into the hole falls a greater or less amount of iris. With one snip of the scissor this iris hernia and the button are removed. The conjunctival flap is replaced and the lids closed. I have never had occasion to suture the conjunctiva. If it is properly put in place, the lid raised and laid down gently over it, it does not roll back. Aqueous will now percolate through this hole, and in a few days a small raised cushion of conjunctiva lies over the hole. The aqueous is absorbed by the lymphatics of the conjunctiva and the eye remains soft. The one great objection to this operation is danger of late infection. A catarrh of the nose, a conjunctivitis, may cause, by virtue of organisms penetrating into this watery cushion, acute virulent infection of the eye. I have seen 2 such cases recently. While admitting that it is a danger, I believe that if the cases are properly selected the danger is very slight. I never do this operation in very old people, whose conjunctiva is often thin as gossamer, having lost its fat with the general loss of fat in old age. I do not do it in

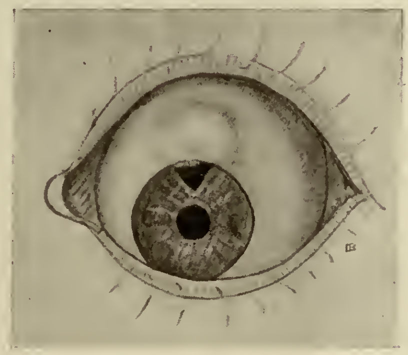

Fig. 318.

people with chronic sinus disease, nor in people whose tear sacs are not absolutely patent. If selected properly, I still believe—although many ophthalmic surgeons have abandoned it—that it is the operation of choice in chronic simple glaucoma. These 4 cases illustrate well the interesting variety of ophthalmic surgery. It may seem a small field to the general surgeon, but in its scope it offers as many interesting and dramatic moments as can well be asked for.

CLINIC OF DR. E. B. TOWNE

STANFORD UNIVERSITY HOSPITAL

FRACTURE-DISLOCATIONS OF THE CARPAL BONES

THE general use of the roentgenogram has added greatly to our knowledge of lesions of the carpal bones. Not only has it given an infallible method of diagnosis, but it has also stimulated interest in clinical and experimental investigations. As a result we now have a clear understanding of the diagnostic signs, and of the mechanism of production, of the three more common injuries. Of these the most frequent is *fracture of the os naviculare* (scaphoid); a fracture rarely diagnosed before the day of the Roentgen ray, and still frequently mistaken for a sprain of the wrist. Less common, but of greater importance because of the necessity of early diagnosis and treatment, is the so-called *anterior dislocation of the os lunatum* (semilunar). This denomination is not entirely correct, for in some instances the lunate remains in normal relationship to the radius and ulna (Fig. 319), while the os capitatum (os magnum) and the rest of the carpal bones are dislocated backward. If the posterior ligament is ruptured, this stage may be followed by a secondary anterior dislocation of the lunate (Fig. 320); and the usual descriptive term was based on this picture. The lunate may rest at any point between the two extremes illustrated. More correct denominations, such as "perilunate dorsal luxation of the hand with or without secondary dislocation of the lunate" (Hirsch), or "subtotal retrolunate luxation of the carpus with or without enucleation of the lunate" (Jeanne and Mouchet), are clumsy; while "dislocation of the lunate" draws attention to the bone which has to be removed in the old injuries, and is anatomically correct if secondary dislocation has occurred. Of still less frequent incidence, but of particular interest because it combines the two above-mentioned lesions, is the injury usually known as *anterior dislocation of the os lunatum with fracture of the os naviculare.* This differs from uncomplicated dislocation of the lunate only in that the proximal fragment of the fractured navicular remains with the lunate, while the distal fragment keeps its contact with the other carpal bones. In addition to these three relatively common lesions there is a large variety of atypical fractures and dislocations which are of interest mainly because of their rarity.

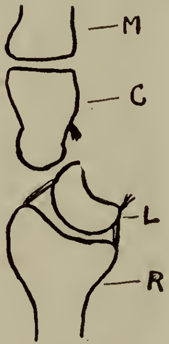

Fig. 319.—"Dislocation of lunate" when anterior ligament only is ruptured; really a posterior dislocation of capitate: *R*, Radius; *L*, lunate; *C*, capitate; *M*, metacarpal.

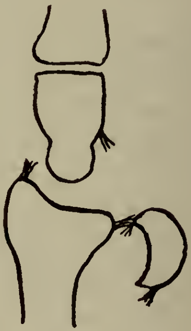

Fig. 320.—Secondary dislocation of lunate after rupture of posterior ligament. Capitate replaces lunate in relation to radius.

I will present 4 case histories to illustrate the late results of carpal injuries. Two patients suffered from dislocation of the lunate with fracture of the navicular, and they offer an interesting contrast between the results of early and late diagnosis and treatment. The third and fourth patients had atypical lesions which were promptly recognized and treated; their histories are presented not only because these fracture-dislocations have not been described in the literature but also because of the excellent results obtained by early closed reduction.

CASE REPORTS

Case I. Anterior Dislocation of Lunate and Proximal Fragment of Fractured Navicular; Fracture of Ulnar Styloid, Head of Radius, and Coronoid Process of Ulna; Compression of Median Nerve. Closed Reduction on Third Day. Physiotherapy. Complete Restoration of Function.—Mrs. J. R. (Disp. No. 104,734), a waitress, aged thirty-one years, was admitted to Lane Hospital on April 17, 1922. She had that morning been struck by an automobile which threw her against a wall. The force of the fall had been received on the palm of the right hand, with the wrist and elbow in full extension. She complained of severe pain in the right wrist and elbow, and of tingling sensations in all but the little finger.

Examination.—The hand was in claw position, with the wrist half-extended and the fingers partly flexed. The wrist was slightly swollen and considerably thickened in the anteroposterior direction. The lower ends of the radius and ulna appeared to be intact and normal except for tenderness on pressure over the ulnar styloid. There was an indefinite hard prominence under the flexor tendons and distal to the forearm bones. Pressure here caused sharp pain in the distribution of the median nerve, in which there was considerable diminution in the ability to feel cotton and pin-prick. On the dorsum of the wrist, between the base of the third metacarpal bone and the lower end of the radius, there was another hard prominence. The distance from the posterior margin of the articular surface of the radius to the base of the third metacarpal was 1 cm. less on the right than on the left. The base of the first metacarpal approached the radial styloid so closely that a finger-tip could not be inserted between the two bones. The patient would not attempt to move the wrist or fingers. There was marked restriction of passive extension of the fingers. At the wrist there was passive flexion to about 30 degrees, but there was no extension, radial flexion, or ulnar flexion.

The clinical diagnosis of the wrist condition was anterior dislocation of the lunate. This was based on: (1) the normal relationship of the styloid processes, (2) the anteroposterior thickening of the wrist, (3) the shortening of the wrist, (4) the claw-hand, and (5) the signs of median nerve compression.

Roentgenograms confirmed and added to the diagnosis. In the anterior projection (Fig. 321) it is seen that the navicular is fractured, and that the wrist is shortened because of dislocation of the lunate and the proximal navicular. The lateral projection (Figs. 322, 323) shows that the lunate and proximal fragment of the navicular have not retained their normal relationship with the radius and ulna, but have been pushed

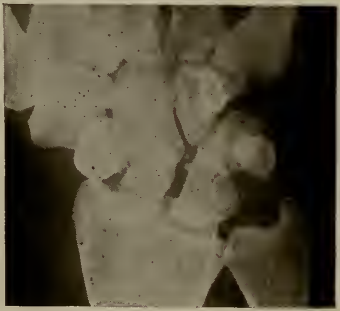

Fig. 321.—Obs. 1. Anterior dislocation of lunate and proximal fragment of fractured navicular. Anterior projection.

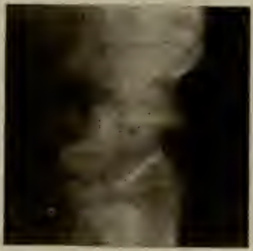

Fig. 322.

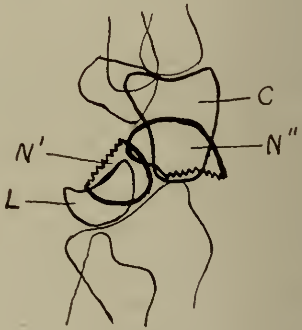

Fig. 323.

Figs. 322, 323.—Obs. 1. Lateral projection. Fig. 323 is a tracing of Fig. 322: *L*, Lunate; *N'*, proximal navicular; *N"*, distal navicular; *C*, capitate.

forward and rotated anteriorly through 30 degrees by the capitate and the other carpal bones. In other words, a dorsal dislocation of the hand in the transnavicular-perilunate line has been followed by a partial anterior dislocation of the lunate and proximal navicular.

Treatment and Result.—On April 19th, two days after the receipt of the injury, the patient was anesthetized with nitrous oxid and oxygen. The hand was pulled down in the line of the forearm, and then, with continued traction, the wrist was hyperextended. The wrist was now flexed while counterpressure was applied to the prominent dislocated bones under the flexor tendons. The bones slipped back into place with the greatest ease. The dorsal and volar prominences and the anteroposterior thickening disappeared; the shortening of the wrist was corrected; and now, with the tip of the finger between the radial styloid and the base of the first metacarpal, crepitus could be obtained by moving the fragments of the navicular. The wrist was immobilized in palmar and ulnar flexion with molded plaster splints. Daily after the fourth day the splints were removed and the wrist was extended to the line of the forearm. After the eighth day active motion in all directions was allowed, and the plaster was replaced by a straight posterior wooden splint. On May 2d, thirteen days after reduction, the splint was discarded and the patient was dismissed from the hospital. At that time flexion of the wrist was almost complete, but extension, radial flexion, and ulnar flexion were limited to about 10 degrees. There was still slight hypoesthesia over the terminal phalanges in the median distribution. For the next seven weeks the patient reported twice a week to the Physiotherapy Department of Stanford Hospital for baking, massage, and exercises. On May 20th Dr. Langnecker made the following note: "Dorsal flexion, half-normal; palmar and radial flexion, normal; ulnar flexion, two-thirds normal."

Eleven weeks after the injury she returned to her work as waitress in a restaurant. At first the wrist was rather painful after eight hours of work. She found that lateral movements, as in slicing bread, were liable to cause pain. On August 18, 1922, four months after the injury, the patient reported at the clinic for another complaint. Examination showed that all tenderness in the navicular region had disappeared, that the sensory disturbances were gone, and that the wrist appeared to be perfectly normal except for slight limitation of extension and ulnar flexion. In roentgenograms made on that day the navicular fragments, seen in the anterior projection, are in good position, but there is no bony union. The absence of tenderness or mobility in the navicular region makes it probable that fibrous union has occurred. The lateral projection (Fig. 324) shows the forearm and carpal bones in normal position.

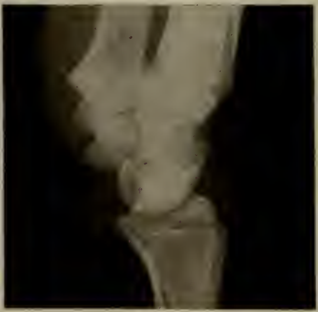

Fig. 324.—Obs. 1. Lateral projection after reduction.

Today, ten months after the injury, the wrists look precisely alike. The grip of the right hand is stronger than that of the left. The patient says that after an especially hard day's work the wrist is sometimes a little lame, but that ordinarily she is not conscious that it has ever been hurt.

Case II. Anterior Dislocation of Lunate and Proximal Fragment of Fractured Navicular. Median Nerve Injury, Paresis, Anesthesia, and Severe Causalgia. Late Excision of Dislocated Bones, Physiotherapy. Poor Functional Result.—Mr. W. J. H. (Disp. No. 79,650), a sign painter, aged forty-five years, was seen in consultation with Dr. Leonard W. Ely at the Marine Hospital of San Francisco on November 13, 1919. Dr. Ely had diagnosed the fracture-dislocation, and wanted an opinion on the condition of the median nerve.

History.—Five weeks previously, on October 10th, the patient fell 30 feet on to the palm of the extended hand. Shortly afterward he noticed tingling and numbness in all but the little finger. The wrist rapidly became swollen, and it was impossible to move the wrist or fingers. The patient stated that a roentgenogram taken that day was reported to be negative. Twelve hours after the accident he began to suffer from severe burning pain in the hand, which had continued without cessation, making sleep impossible. He had found that warm water slightly relieved the causalgia.

Examination.—The patient was apprehensive, and was evidently suffering severe pain. The right forearm and hand were on a wooden splint and were covered with moist gauze, on to which he frequently dropped warm water from a sponge. The soft parts were markedly swollen, and the skin was macerated. The wrist was slightly extended and the fingers were partly flexed. There was no voluntary motion of fingers or wrist. Passive motion of the wrist was limited to a few degrees of palmar flexion. The radial and ulnar styloid processes were in normal position. No carpal landmarks could be made out because of the edema of the soft parts, but there seemed to be considerable anteroposterior thickening of the wrist. There was constant fibrillary twitching of the muscles of the thenar eminence. All forms of sensation were lost in the distribution of the median nerve to the hand. Pressing over the course of the nerve in the arm caused aggravation of the causalgia. After the right hand had been exposed to the air for an hour it was much warmer than the left, and the skin was red and glossy. The nails of all except the little finger showed dull surfaces and transverse ridges.

Roentgenograms taken at the Marine Hospital are shown in Figs. 325–327. In the anterior projection it is seen that the navicular is fractured, and that the proximal fragment is rotated, and, with the lunate, dislocated forward. The lateral projection shows that the capitate and other carpal bones are dislocated backward; and that the lunate and proximal navicular fragment have not retained their proper relationship to the radius and ulna, but have been secondarily dislocated forward. In this process the lunate has rotated slightly forward, and the proximal navicular has rotated almost 90 degrees backward.

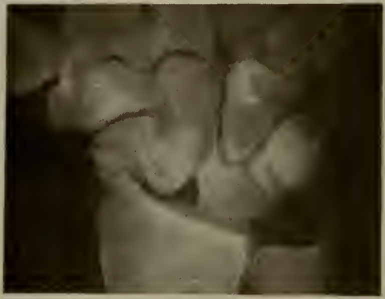

Fig. 325.—Obs. 2. Anterior dislocation of lunate and proximal fragment of fractured navicular. Anterior projection.

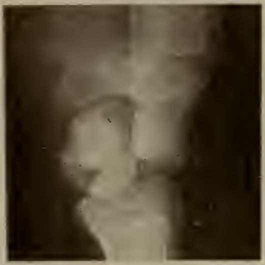

Fig. 326.

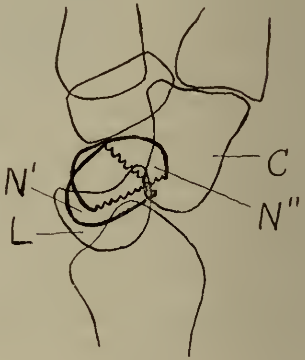

Fig. 327.

Figs. 326, 327.—Obs. 2. Lateral projection. Fig. 327 is a tracing of Fig. 326: *L*, Lunate; *N'*, proximal navicular; *N''*, distal navicular; *C*, capitate.

Treatment and Result.—It was not possible to reduce the fracture-dislocation. On November 21st Dr. Ely excised the lunate and proximal fragment of the navicular through a volar incision. The median nerve, throughout the length of the incision, was of normal size and showed no evidence of compression except a moderate hyperemia.

For two days after operation the causalgia was very severe; then it gradually disappeared. Four weeks after operation the sensory loss, palsy of the small muscles of the hand, and vasomotor disturbances were unchanged. With subsidence of the swelling of the soft parts it was evident that there was a good deal of atrophy of the thenar muscles. The wrist had 45 degrees of palmar flexion, 10 degrees of ulnar flexion, and no extension or radial flexion. From December 27th onward the wrist and fingers received daily baking, massage, passive motion, and exercises in the Physiotherapy Department of Stanford Hospital. During the second month after operation there was slight improvement in the domain of the median nerve, but none in the motions of the wrist. By the first of March, 1920 the patient could flex the finger-tips to within $\frac{3}{4}$ inch of the palm, and oppose the thumb and little finger. The strength of the hand was sufficient so that he could cut meat with a sharp knife, and could hold a match firmly enough to strike it. The sensory disturbance had cleared over the palm and thumb, but had not changed over the index, middle, and ring fingers. The hand was still warm, moist, and slightly cyanotic, and the finger-nails were growing very slowly. The wrist was not improving and it hampered him in his work. He had learned to use the left hand when wrist motions were required, as in painting the letter O.

It was felt that the absolute restriction of radial and dorsal flexion was due to the presence of the distal fragment of the navicular (Fig. 328). The patient entered Lane Hospital, where, on March 13, 1920, Dr. Ely excised this bone through a lateral incision. Figure 329 is a roentgenogram of the wrist taken after the second operation. Physiotherapy was continued. Six weeks after the second operation he returned to work. In July, 1920 palmar flexion was almost normal, ulnar flexion was less than half of normal, and extension and radial flexion were absent. There had been no improvement in the sensory loss. He had cut the tip of the index-finger deeply without feeling pain. In March, 1921, a year after the second operation, it was evident that no further improvement in the function of the wrist-joint was to be expected. Flexion of the fingers and opposition of the thumb were weak, and the volume of the thenar muscles was less on the right than on the left. No change had taken place in the sensory loss or in the motions of the wrist during the previous eight months. The education of the left hand had progressed, so that he carried on his trade without difficulty.

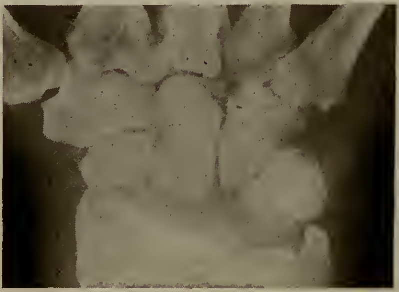

Fig. 328.—Obs. 2. Anterior projection after first operation.

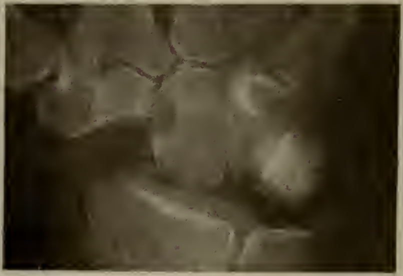

Fig. 329.—Obs. 2. Anterior projection after second operation.

Discussion of Observations of Cases I and II.—The roentgenograms show that the lesions of these two patients were almost precisely similar. It would not be fair, however, to say that the difference in the final result is entirely due to early reduction in one instance and late excision of the bones in the other, for this would leave out of account the loss of function resulting from the median nerve injury. The first patient's full range of wrist motions may be attributed to early reduction and proper after-treatment. The second patient's restriction of wrist motion is certainly due to the delay in diagnosis which made excision of the bones necessary, and it occurred in spite of similar after-treatment. But the weakness of the hand muscles supplied by the median nerve was a considerable factor in the poor functional result which the first patient showed sixteen months after injury. Whether the nerve lesion would have been less severe had an early reduction been done is problematic.

Anterior dislocation of the wrist, with or without fracture of the navicular, is almost invariably accompanied by some degree of median nerve compression. Tavernier,[1] who first emphasized this fact, says that signs of nerve injury are of great diagnostic importance. The carpal canal, through which the flexor tendons of the fingers and the median nerve pass, is bounded in front by the anterior annular ligament and in back by the carpal bones. The posterior annular ligament lies on the dorsal aspect of the carpal bones. When the lunate lies in the same plane with, and anterior to, the capitate (Figs. 323, 327) the carpal canal is narrowed, and the anterior edge of the lunate presses on the nerve and tendons. Rarely are the symptoms of nerve compression so severe as to dominate the picture, as in the second observation. Delbet[2] has described a severe median causalgia which was cured by removal of the dislocated lunate and navicular fragment; in this instance also the nerve was not grossly abnormal.

Case III. A Hitherto Undescribed Lesion; Anterior Dislocation of Proximal Fragment of Fractured Navicular. Posterior Dislocation of Lower End of Ulna. Median Nerve Compression. Closed Reduction on Second Day. Excellent Functional Result. (I am indebted to Dr. Alanson Weeks, of San Francisco, for permission to publish this case report.)—Mr. W. T. R. (Hosp. No. 21,423), a marine engineer, aged fifty years, entered Stanford University Hospital August 25, 1920. On that morning, while lying prone with his hand palm downward on the deck, he received a direct blow on the dorsum of the left wrist from the edge of an iron door, 2 feet square and $\frac{1}{4}$ inch thick, which fell a distance of about 2 feet. He found that he could move his wrist and fingers normally. He noticed a small hard tumor on the flexor aspect of the wrist. All but the little finger soon became numb. A few hours after receipt of the injury a transverse lacerated wound which exposed the posterior annular ligament was sutured by Dr. Leroy Brooks.

Roentgenograms.—The anterior projection (Fig. 330) shows a transverse fracture of the navicular. In the lateral projection (Figs. 331, 332) it is seen that the proximal fragment of the navicular is dislocated forward, while the lunate retains its normal relationship to the capitate and to the bones of the forearm. There is also a backward dislocation of the lower end of the ulna.

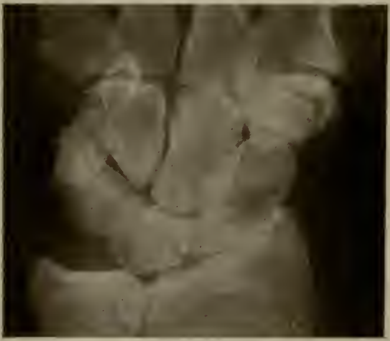

Fig. 330.—Obs. 3. Anterior dislocation of proximal fragment of fractured navicular. Anterior projection.

Treatment and Result.—On August 26th, twenty-four hours after the accident, the patient was anesthetized and a closed reduction was done by Dr. Weeks. The wrist was immobilized on an anterior wooden splint. The lateral roentgenogram shows that the dislocated fragment is in place, but somewhat posteriorly rotated (Fig. 333). The dorsal wound healed without suppuration. The hypoesthesia in the median distribution cleared rapidly and was barely demonstrable four days after reduction. The range of wrist motions improved gradually.

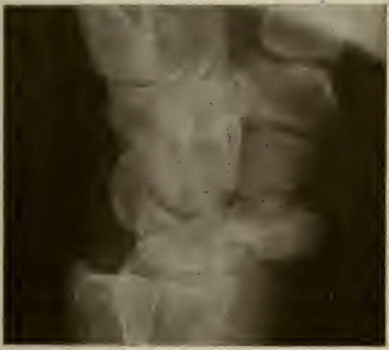

Fig. 331.

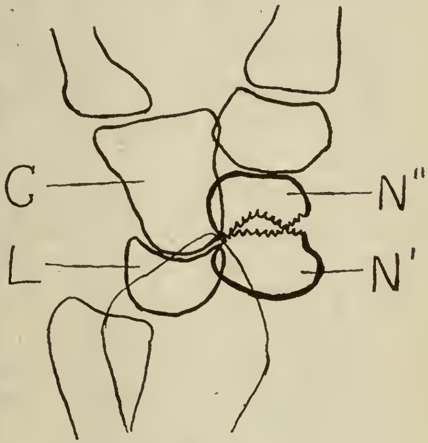

Fig. 332.

Figs. 331, 332.—Obs. 3. Lateral projection. Fig. 332 is a tracing of Fig. 331: *L*, Lunate; *N'*, proximal navicular; *N''*, distal navicular; *C*, capitate.

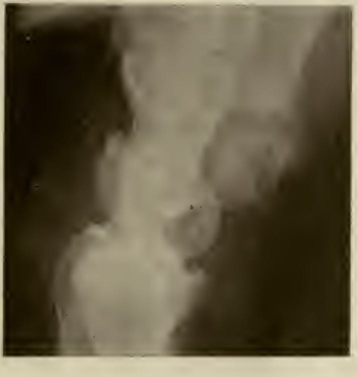

Fig. 333.—Obs. 3. Lateral projection after reduction.

In December, 1920 the patient reported by letter to Dr. Weeks that he was carrying on his work with a useful and painless wrist. At the present time, two and a half years after the accident, he is at sea. His wife stated that the wrist is sometimes a little painful, and that a few months ago, following further trauma, it was swollen for several weeks.

Discussion.—I have not been able to find a record of a similar lesion in the literature. Riedl[3] and Ludloff[4] have reported anterior dislocations of the intact navicular. Auvray[5] has described posterior dislocation of the distal fragment of a fractured navicular, and quoted a similar observation by De Fortunet.

This lesion was produced by direct violence to the dorsum of the wrist, probably combined with torsion, as indicated by the site of the wound and by the dislocation of the lower end of the ulna.

Case IV. A Hitherto Undescribed Midcarpal Fracture-dislocation; Peri-triquetro-lunate Anterior Dislocation of the Hand, with Fracture of the Navicular. Closed Reduction. Physiotherapy. Perfect Functional Result.—E. K. (Disp. No. 78,560), a boy aged eleven years, entered the Surgical Clinic of the Stanford Out-patient Department on June 3, 1921, complaining of a sprained left wrist. Ten days before, on May 24th, he tripped and fell on the palm of the hand. Examination showed that the wrist was slightly swollen, and that there was tenderness on pressure over the navicular bone. A diagnosis of fracture of the navicular was confirmed by the roentgenograms (Figs. 334, 335), and the wrist was immobilized in the line of the forearm by means of a molded plaster splint. Seventeen days later (June 20th) the splint was discarded.

On July 9, 1921 the patient returned to the clinic with a marked deformity of the left wrist which had occurred as a result of hyperextension during a scuffle a few hours previously. Further questioning brought out the fact that the same deformity had followed the original injury on May 24th. At that time his mother had "made the bone snap back in place" by pressure on the front and the back of the wrist. While the wrist was flexed the bones stayed in position, but when it was extended beyond the line of the forearm the dislocation recurred.

He frequently produced and reduced the deformity, without any pain, during the next few days. His mother sent him to the clinic on June 3d because a neighbor had suggested that the boy had a broken rather than a sprained wrist. In the clinic the patient did not produce or describe the dislocation, so that the roentgenograms of that day showed nothing but the fractured navicular. After the removal of the splint on June 20th he could extend the wrist without producing the deformity, which did not occur again until July 9th.

Examination.—There was marked anteroposterior thickening of the wrist, with bony prominences across its volar and dorsal aspects. The bases of the metacarpal bones were displaced forward. The wrist was shortened, so that the base of the third metacarpal bone was about half the normal distance from the posterior margin of the articular surface of the radius. The lower ends of the radius and ulna appeared to be intact. On the dorsum of the wrist the transverse ridge was formed not by the radius and ulna, but by the proximal row of carpal bones. Distal to the ridge there was a depression across which the extensor tendons of the fingers passed. The volar ridge was less easy to palpate, but it seemed to be formed by the distal row of carpal bones. The range of motion of the fingers was only

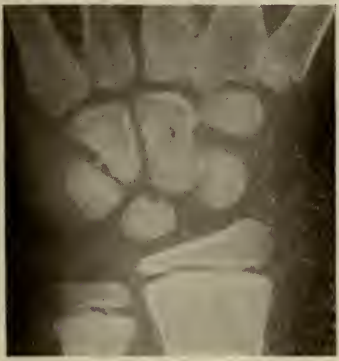

Fig. 334.—Obs. 4. Anterior projection of June 3d; fracture of navicular.

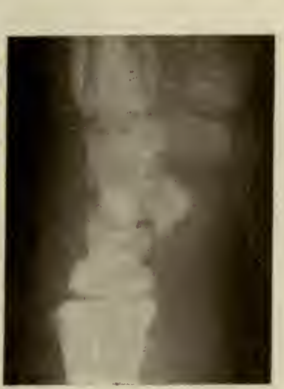

Fig. 335.—Obs. 4. Lateral projection of June 3d; fracture of navicular, no dislocation.

slightly restricted. There was no voluntary motion of the wrist, and passive motion was markedly limited. There were no signs of nerve compression. Slight traction with pressure on the bony prominences reduced the dislocation, but when the wrist was extended beyond the line of the forearm the deformity recurred. The diagnosis was midcarpal anterior dislocation of the hand.

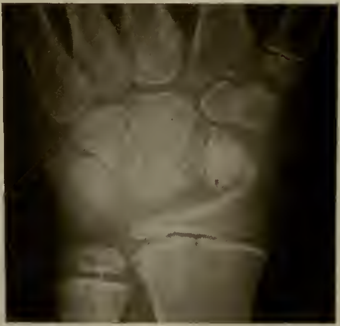

Fig. 336.—Obs. 4. Anterior projection of July 9th; midcarpal anterior dislocation with fracture of navicular. Compare with Fig. 334.

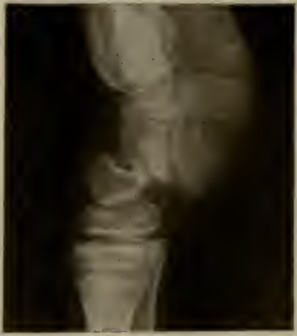

Fig. 337.

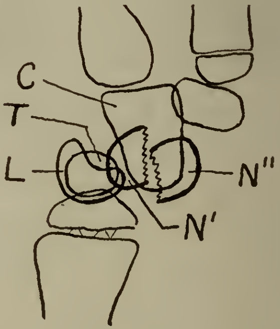

Fig. 338.

Figs. 337, 338.—Obs. 4. Lateral projection of July 9th. Fig. 338 is a tracing of Fig. 337. Compare with Fig. 335. *L*, Lunate; *T*, triquetrum; *N'*, proximal navicular; *N''*, distal navicular; *C*, capitate.

Roentgenograms (Figs. 336–338).—The lunate and triquetrum (cuneiform) lie in normal relationship to the forearm bones. The distal row of carpal bones, accompanied by the fractured navicular, is dislocated forward. The distal fragment of the navicular is displaced upward, but the proximal fragment remains in normal contact with the capitate.

Treatment and Result.—After reduction of the dislocation on July 9th the wrist was immobilized in the flexed position by means of a circular plaster dressing. Ten days later the plaster was cut and removed while active motions of the wrist were carried out. This was repeated three times a week. On the twentieth day the plaster dressing was discarded and a posterior wooden splint was applied for the next ten days. On August 6th there was no lateral motion or extension, and flexion of only 10 degrees. A roentgenogram (Fig. 339) made on that day shows the carpal bones in normal position.

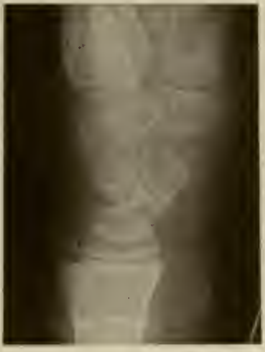

Fig. 339.—Obs. 4. Lateral projection after reduction.

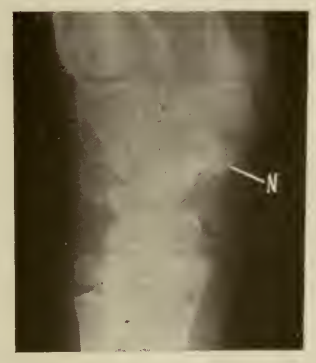

Fig. 340.—Lateral projection seven months after injury, to show bony union of navicular (*N*).

From the middle of August until the middle of October the patient reported twice a week to the Physiotherapy Department of Stanford Hospital for baking, massage, aërated baths, and exercises. On October 15th, three months after reduction, there was almost complete range of wrist motions, and the strength of the wrist was only slightly below normal. Pressure over the navicular did not cause pain. A roentgenogram taken on February 11, 1922, seven months after the injury, shows bony union of the navicular (Fig. 340). There was no difference in the appearance in the range of motion or in the strength of the two wrists. Today, twenty months after reduction, it is impossible to detect the injured wrist without referring to the roentgenograms.

Discussion.—I have found in the literature 6 instances of midcarpal anterior dislocation of the hand which were controlled by roentgenograms and sufficiently described to make the pathology unmistakable. All of these lesions differ in some respect from that detailed above. In three observations, those of Goullioud and Arcelin,[6] Mouchet and Vennin[7] and Tanton,[8] the proximal fragment of the navicular, lunate, and triquetrum remained in normal position, while the distal row, accompanied by the distal fragment of the navicular, was dislocated forward. Cotte[9] has described an anterior dislocation of the distal row accompanied by the intact navicular and triquetrum, while the lunate only remained in place. Tilmann[10] has reported a true midcarpal dislocation, in which the proximal row of carpal bones remained in position and the distal row was anteriorly dislocated. Douarre's[11] patient showed the lunate and triquetrum in normal position, while the distal row, accompanied by the intact navicular, was anteriorly dislocated.

Aside from its interest as a rarity, this observation seems to be of importance from two other points of view. It is said that if any union takes place in a fractured navicular, it is fibrous union; but the roentgenogram (Fig. 340) shows clearly that true bony union occurred. The perfect functional recovery, though partly due to early reduction, was undoubtedly greatly aided, as in Observation I, by the painstaking after-treatment given in the Physiotherapy Department under the direction of Dr. H. L. Langnecker.

Conclusion.—The practical importance of the subject lies in the fact that an unrecognized and untreated anterior dislocation of the lunate, with or without fracture of the navicular, gives a gloomy prognosis, as illustrated by Observation II; while early reduction and appropriate after-treatment of these or of the rarer lesions offers an excellent outlook, as shown by the other three observations.

How, then, are these lesions to be recognized? The clinical signs are sometimes clear cut, as in Observation I—intact lower ends of the forearm bones, anteroposterior thickening and shortening of the wrist, claw-hand, and signs of median nerve compression. But again, as in Observation II, the swelling of the soft parts obscures the landmarks. Therefore, in every instance, anterior and lateral roentgenograms are essential; and they require careful study and comparison with films of the normal wrist, for it is probable that no roentgenogram is more difficult to interpret than is a lateral view of the carpus.

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CLINIC OF DR. S. L. HAAS

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THE IDEAL BONE-GRAFT AS DETERMINED BY EXPERIMENTAL INVESTIGATIONS

A considerable amount of discussion has arisen in regard to the most suitable form of bone for transplantation. Thus, there are numerous expressions of opinions between the two extreme views; of those, on the one hand, who maintain that the graft should consist of a live piece of bone; to those, on the other hand, who maintain that it is of no significance whether the bone is dead or alive. It cannot be denied that successful results may be obtained with dead bone or even a foreign substance, but in spite of such results there may be, under unfavorable circumstances, preventable failures. It is difficult to draw definite conclusions from the results of operations on patients because of the variations in the conditions existing at operation, such as the character of the bone and surrounding tissues, the health of the patient, and the variation in the type of the operation. It is believed that the results obtained from experiments on animals present more definite criteria for judging the behavior of the various kinds of grafts, because of the possibility of more uniform conditions and the opportunity of microscopic study of the various changes. Due consideration must be allowed for the possibility of greater reparative and regenerative power of the lower animals, as well as a variation in different animals.

It may be well to recall briefly the changes that take place in a piece of bone after transplantation. In consequence of the sudden cessation of the blood-supply there is an immediate degeneration of some of the cells, while others, because of their greater viability, are able to survive. In about ten to twenty days one is able to distinguish definite signs of regeneration in the region of the periosteum, endosteum, about the lining of the haversian canals, and on the outer surface of the trabeculæ; from which foci there is a gradual progression to the complete regeneration of the bone. The changes just enumerated take place in bone that is buried in muscle and removed from any possible source of invasion of bone. Some investigators maintain that the new bone arises from the surrounding connective tissue by a process of metaplasia.

It is of considerable practical as well as of scientific interest to know whether the transplant remains alive and is capable of forming callus; because the successful application of the bone-graft necessitates the union of the graft at one or both ends with the host; in other words, the healing of a fracture in which one fragment is represented by the host and the other fragment by the graft. If the graft is dead, then all the uniting callus must be formed by the host, but if the graft is alive then it may share in the process of union. It can be proved that a transplanted bone is capable of forming callus by placing a bone that has been broken in muscle. It will be found that the two fragments will unite in a similar manner as a fracture under ordinary conditions. That this property of forming callus is dependent upon live bone can be proved by placing a fractured dead bone in muscle; and it will be found that there will be no attempt at repair or signs of activity at the site of fracture. That the live transplanted bone has not only the property of forming callus, but has definite invasive power can be shown by placing a live fragment of bone in contact with a dead piece of bone in muscle. It will be found under favorable conditions that there will be a union of the two fragments and that there will be live finger-like processes penetrating the dead bone. It is believed that these experimental findings firmly establish the independent power of regeneration inherent in transplanted bone.

Certain cells of transplanted bone not only live, as in the usual method of transplantation, but, in addition, are capable of withstanding a varying exposure period under different environments. It has been found that union will occur in a transplanted fractured bone that has previously been exposed to air in a sterile bottle for nineteen hours. Furthermore, definite signs of proliferation, both osteoid and cartilaginous, have been found at the site of fracture in a transplanted bone that had been exposed to a freezing temperature for three days. These facts offer uncontroverted evidence of the retained living property of the osteogenetic cells of transplanted bone.

Another mooted point in regard to the transplanted bone is concerned with the advisability of having the periosteum and endosteum attached to the graft. Utilizing the fact that a fractured transplanted bone will unite, it was decided to determine the effect of the removal of the periosteum, the endosteum, or both on the healing of such fractures. It was found that when the endosteum was curetted there was but a slight hindrance to healing, that when the periosteum was removed the disturbance was more marked, but when both periosteum and endosteum were removed there was always a failure of union and very slight evidence of activity about the fracture site. Therefore it was concluded that it is preferable to have the periosteum and endosteum intact when the maximum of osteogenesis is desired in a bone-graft.

In view of the experimental findings it is deemed advisable to utilize the live bone, with both periosteum and endosteum attached, for all operative procedures necessitating the use of transplanted bone.

CLINIC OF DR. LUDWIG A. EMGE

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Stanford University Hospital

AN EARLY BENIGN ADENOMA OF THE APPENDIX

It is surprising how little the literature has to offer us on early neoplasms of the appendix. It is impossible to say how many thousands of appendices have been removed during the past decades. The number must be very high, and, consequently, one would expect to find a great deal of information regarding the very early stages of these new growths. Unfortunately, this is not the case. We are safe in saying that the large majority of appendices removed were not studied microscopically in the past surgical eras. A great deal of information has thus been lost to us, so today there are only about 400 cases of neoplasm of the appendix on record. It is significant that the vast majority of these, about 90 per cent., were discovered accidentally. With the advent of better laboratory facilities these discoveries have increased. It is, therefore, the last decade which marks a sudden increase in reports of neoplasms of the appendix which signifies rather a relative than an actual increase to be credited to the more universal adoption of examination of tissues removed and the increasing popularity of exploration in the course of any abdominal operation. These procedures have led to many accidental discoveries of pathologic structures, mainly neoplasms, which while they had no bearing upon the symptomatic disturbance of the patient at the time, would have soon endangered life had they been allowed to remain. For many years the Department of Obstetrics and Gynecology of the Stanford School of Medicine has followed this routine of exploring the abdomen and examining tissues, and in the course of time invaluable information has been collected.

It was at the occasion of a pelvic operation that the inspection of the appendix revealed a sharply circumscribed, globular, fairly solid tumor, situated in the middle third of this intestine. Its size, although barely more than 1.5 cm. in diameter, and the fact that it was bound down tightly by old adhesions, suggested that a chronic inflammation was present and that a fecal concretion had formed. The appendix was, therefore, removed, but not measured until hardened in a formaldehyd fixative.

The patient, a woman of thirty-nine, had no recollection of any intestinal disturbances. She came to operation on account of extensive plastic derangements of the generative organs secondary to birth trauma. In connection with our findings in the appendix, to be reported presently, it is of interest to note that this patient also had an advanced polypoid hyperplasia of the endometrium bordering on adenoma and a polyposis of the nasal mucosa. In other words, she presented a tendency to hyperplasia of mucous membranes in general.

The hardened appendix, dusky from general congestion, and covered with firm adhesions, measured 4 cm. in length. The greater portion of the middle third was occupied by the tumor mass described, and at operation thought to be a fecal concretion. When sectioned at various levels it seemed that the lumen of the organ was completely obliterated except in its middle third, where it was distended and filled with a circumscribed mass suggestive of glandular tissue. Sections for microscopic study were then cut from various levels, the portion housing the tumor being sectioned serially.

The study of the sections from the regions directly below and above the tumor mass revealed an old chronic obliterative appendicitis. In the proximal third the lumen had been completely obliterated by a fibrous cord. Glandular and lymphoid structures could not be found. There were a number of plasma cells and polymorphonuclear leukocytes present. In the distal third (Fig. 341) the lumen, although reduced to half of the normal width, was still patent for a distance of about 0.5 cm. just above the tumor. It was lined with a mucosa containing few remnants of glandular structures. Lymph-follicles were still

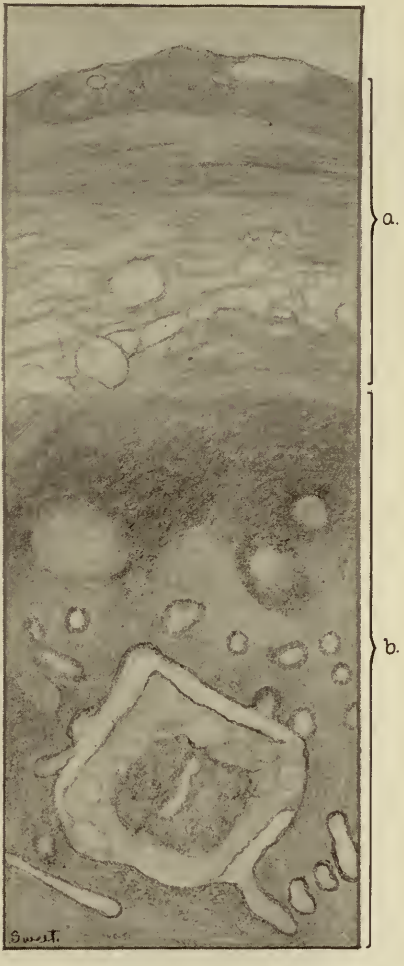

Fig. 341.—A very low magnification of a section through the distal third of the appendix: *a*, The muscle wall is thin, but the submucous connective tissue is increased; *b*, mucosal glands are displaced and scarce. Lumen is small and filled with necrotic tissue. Lymph-follicles are present. Under higher magnification it was seen that a portion of the mucous lining in the lumen was destroyed. At this level the appendix presented a picture of an obliterative chronic appendix.

abundant. The lumin contained necrotic cellular material mixed with pus-cells. Polymorphonuclear eosinophils were abundant in this portion of the appendix. The remaining por-

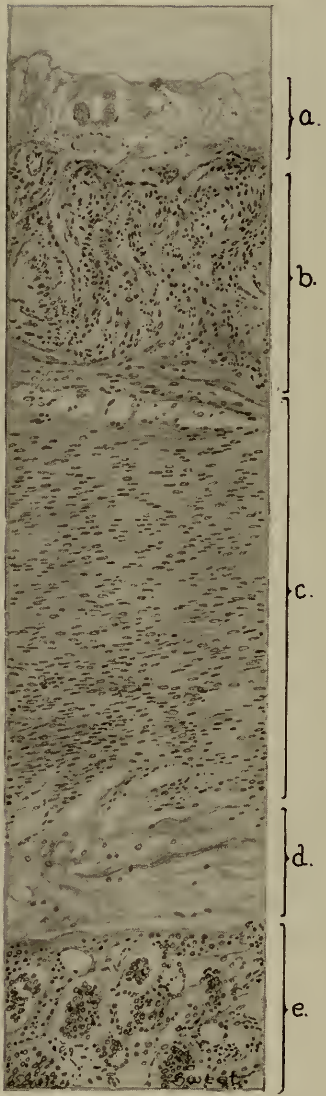

Fig. 342.—A section taken through the middle third of the appendix and showing the portions nearest the mesentery and seen under low magnification: *a*, Serosa; *b*, muscular layer, the latter slightly thinned out; *c*, greatly hypertrophied submucosa transformed into a capsule; *d*, the vascular layer of the capsule from which spring the supporting connective-tissue structures for the glandular components; *e*, portion of the tumor mass.

tion of the distal third presented the same picture described for the proximal third.

The middle third of the appendix was for the greater part occupied by a glandular tumor mass enveloped in a capsule which, although irregular in outline, seemed to be intact except where it bordered the reduced lumen of the distal third. This structure apparently sprung from the submucosa, and by hypertrophy and fibrosis ultimately formed a capsule sharply differentiated from the surrounding muscle wall. Both the capsule and the muscle wall had their greatest thickness at either side of the mesenteric attachment (Fig. 342) and their greatest thinness farthest away from it. A muscularis mucosæ could not be seen. Within the capsule was a mass of glandular structures, irregular in shape and size, the components of which were well supported by connective-tissue walls. At the periphery of this glandular mass there were well-defined and thickly packed lymph-follicles, similar in appearance to those usually seen in any appendix. All of these follicles were within the confines of the capsule. The greatest portion of blood and lymph supply was situated in the wall of the capsule, being most numerous where it was thickest. The glandular mass had only a very scanty blood-supply. The serosa of the appendix in this region did not present anything unusual except for signs of vascular stasis.

Under high magnification it was easily seen that the supporting connective tissue of the glandular components of the tumor took its origin from the innermost layer of the capsule (Fig. 343). The connective-tissue cells were well formed and mature, often stellate and interlacing (Fig. 344). Distributed throughout this supporting network of connective tissue there were many polymorphonuclear eosinophils.

The glandular components when studied at one level were of irregular outline and varied greatly in size (Fig. 343). There were from a few to a hundred of these components seen in one field according to the width of the level. Each component or alveolus consisted of from 20 to 200 cells when seen in cross-section. The larger glandular masses were confluent and the majority of the glands were solid. Many contained vacuolated

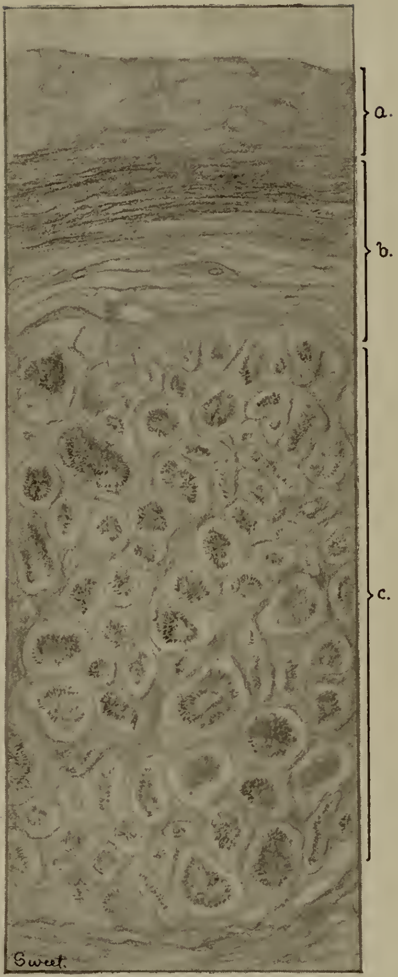

Fig. 343.—Section from the same level of Fig. 342, but seen under higher magnification and showing the capsule and muscularis farthest away from the mesentery where they were thinnest. The glandular components can be seen clearly defined and varying in size. The sharp demarcation of the glandular mass is clearly seen: *a*, Muscularis and serosa; *b*, capsule; *c*, tumor mass.

bodies of various sizes simulating lumina (Fig. 344). These bodies we interpreted as an accumulation of secretory material. Their size determined the relation of the cells to the stroma.

When a number of these vacuolated bodies had become confluent near the center of a glandular component the cells were crowded toward the stroma and the glandular mass assumed true acini formation. Such a configuration was comparatively rare in this tumor. As a rule, vacuolated bodies were distributed irregularly throughout the glandular component, giving it a honeycombed appearance. In many instances there was a tendency for these bodies to accumulate near the periphery rather than

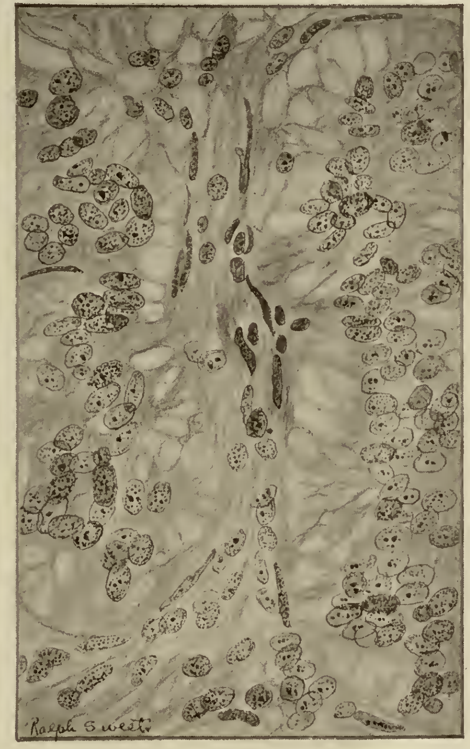

Fig. 344.—A section from the same level as presented in Fig. 342, but seen under very high magnification. The long slender nuclei of the basement membrane cells are easily distinguished. Vacuolated bodies can be seen everywhere. In the two glandular components seen here secretory material is being stored toward the periphery of the component. Note the uniformity of the nuclei, as well as the absence of mitotic figures. An attempt of some of the cells to arrange themselves at right angles to the basement membranes is seen in the glandular portion on the right. Note the absence of goblet cells.

at the center of the glandular unit (Fig. 344). This accounted for a massing of cells farthest away from the basement membrane. The smaller glandular components were surrounded by a definite basement membrane which became indistinct and often broken when these masses assumed larger proportions. Large glandular units were confluent and could be followed through the entire series of sections.

The cells constituting the glandular units were uniform in appearance. Their shape, which was either polygonal or ovoid in outline, was determined by the amount of secretion that was present within the cell or by the accumulation of secretory materials which exerted a pressure upon the cell from without. Secretory materials within the cell also determined the position of the nucleus, but did not alter the shape. A full cell had a basal nucleus, while in the empty cell the nucleus moved to the center of the cell. Nuclei were commonly arranged in the long axis of the cell. Since the secretory material did not necessarily accumulate in the center of the glandular unit, but often did so along the basement membrane, the arrangement of the cells was irregular in relation to the latter. If secretion accumulated within the cell mass only the cells would tend to line up at right angles to the basement membranes. But if the secretion was stored elsewhere in the unit the position of the cells was without any definite relation to this membrane.

The cells of the glandular as well as supporting tissues stained well and evenly. There were no ciliæ seen, nor were there any goblet-cells found. The individual cell occasionally resembled that of the normal gland of the appendix. The nuclei of the secreting cells were oval or ovoid, well defined, containing a broken skein of chromatin material, and one or two very small eccentric nucleoli. They were uniform in size and quite similar to those of the secreting cell of the normal appendix. The position of the nuclei has been described above. Mytotic figures were looked for with great diligence, but none were found. After a minute study of the entire tumor we concluded that an invasion of the capsule or vessels had not taken place.

There are then certain definite factors standing out in our observation:

(1) Individual cells of the glandular masses are all of the same type. Goblet-cells are not present. A basement membrane is present. Confluence of cell masses by breaking through this membrane is frequent.

(2) Many of the secretory cells have an appearance similar to those of the mucosa of the normal appendix.

(3) The tumor has a definite capsule derived from the submucous connective tissue of the appendix.

(4) There is complete absence of demonstrable mytosis in the tumor mass.

(5) There is no penetration of the capsule and no invasion of the vessels.

(6) The tumor is bounded by an old chronic inflammatory process manifesting itself in obliterative appendicitis.

In analyzing this tumor we decided to class it as a benign adenoma most likely originating from isolated cell-nests of an inflamed appendix. We justify this classification on the basis of the six criteria mentioned above. Its inflammatory origin is highly suggestive and fits in well with Verse's theory of the origin of these tumors.

When we attempted to classify this tumor we found that its cytologic picture would not fit in with either of the two general types of glandular tumors of the appendix known. These two types are the malignant cylindric cell adenomas or gelatinous carcinomas typical of intestinal carcinoma in general, and the relatively benign small cell adenomas or carcinoids which resemble the basal cell carcinomas of the skin. The majority of appendical neoplasms belongs in the second group. Primary gelatinous carcinomas of the appendix are comparatively rare. There are only 25 of these reported in the literature. The greater proportion of appendical neoplasms is obscured by intestinal new growth elsewhere. Nevertheless, it is safe to assume that all carcinoids and, in fact, every adenoma of the appendix may ultimately become definitely malignant, although it may be slow in invading the surrounding viscera.

The tumor described here does not belong in the first general class of appendical neoplasms, since it is devoid of goblet-cells. It is excluded from the second group because it forms definite glandular structures which are not found in carcinoids. We therefore choose to class this tumor under the heading of "benign adenoma," although we do not deny that such a tumor must be considered precancerous in character and may constitute an aberrant type of the carcinoid group.

In regard to its early clinical significance there is very little to say, since it failed to give any appreciable symptoms. This is true of any early neoplasms of the appendix which are symptomless until invasion of the surrounding viscera or marked distention of the primary organ has taken place. It is said that occasionally mild symptoms of a chronic appendicitis will accompany these early tumors, but there is no way to differentiate the two conditions. Once invasion has taken place the symptomatology characterizes itself by a host of intestinal disorders that culminate in intestinal obstruction, and commonly the tumor is easily detected. The great majority of the early tumors are found accidentally. Their relation to other neoplasms of the intestine is as 1 to 250. Various writers have estimated that $\frac{1}{2}$ to 1 per cent. of all appendices removed contain neoplasm of one sort or the other. Slightly more than half of these tumors are found in women. This is a relative finding and explained by the more frequent operative entrance of the female abdomen. Seventy per cent. of these tumors are found in the second, third, and fourth decades of life, a period into which fall the greater number of abdominal operations.

Since early neoplasms of the appendix and other organs give so little warning, a plea is made that, if feasible, all abdominal organs be explored in the course of any abdominal operation. This will be a decided step forward in prophylactic surgery. It is furthermore asked that in the interest of science every appendix removed should be examined microscopically by a competent observer well trained in the interpretation of pathologic findings. Excluding emergencies and purulent abdomens there is no excuse for not carefully exploring the abdominal viscera. To fail to examine tissues removed at operation merely means to defeat science, and keep surgery at a level of mechanical skill applied to human anatomy.

CLINIC OF DR. R. R. NEWELL

From the Department of Roentgenology, Stanford University Hospital

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CALCIFICATION IN BRAIN TUMORS

In 1914 Schlesinger and Schüller[1] called attention to the relation of "dural endotheliomata" and even gliomata to overlying osteomata of the calvarium. Calcification in the pineal has long been known, and may be an aid in diagnosis through its normal size (ruling out pineal tumor) or by displacement from the midline, as Schüller[2] has shown. Also calcified plaques in the falx (psammoma) are not so very rarely found postmortem. But of calcifications within the brain itself (including hypophysis) I have found mention of only 38 cases in the literature. Taft[3] reports one discovered postmortem in the brain of a case with mental symptoms, and cites cases reported by Bamberger, Mallory, Catola, Obendorfer, and Dürck, all extensive and discovered postmortem, the first some seventy years ago. Schüller[2] cites Lichtheim, Fittig, Grumach, Robinson, Algyogyi, Sterz, and Stich as having seen areas of calcification in roentgenograms, and himself adds 5 cases. Yet Schüller had 5500 head *x*-rays in his collection. Murphy[4] cites Klineberger, Steida, and Sträter in addition, and himself reports one case. Heuer and Dandy[5] found 6 cases of calcification in 100 consecutive brain tumors. One of these may have been a glioma, the others were: an osteosarcoma, an aneurysm of internal carotid, a cyst of Rathke's pouch, a tumor of optic nerve sheath, and a calcification in hypophysis. They also note one bilateral calcification in the choroid plexus, one calcification in the falx, and 17 cases of calcified pineal. Since then single cases have been reported by George,[6] Souques,[7] Bassoe and Hassin,[8] Jaulin, Limouzi and Coville,[9] and Miller.[10] In discussing George's paper Manges reported 2 instances, and George told of writing to 25 roentgenologists and eliciting only one more instance (by Bowen). Merrill[14] had a case of teratoma of the pineal containing bone. Magnus, in Christiania, reported a case, but the publication is not readily available (Norsk. Mag. f. Laegevidensk, 82, 797, November, 1921). Marburg and Ranzi[11] reported 318 cases of proved brain tumor (1901–19), with *x*-ray findings positive in only 33. But they do not say how many, if any, of these 33 were calcified. Clarke[12] has reported 99 cases of brain tumor, and Locke[13] 107 verified and 60 unverified cases, yet neither of them mentions calcification being concerned with classification and prognosis.

Report On One Year's Cases.—In the year 1922 this department examined 242 head cases (exclusive of sinus examinations). Of these, 227 sets of films were available for study. These comprise:

Brain tumor verified,	9 cases
Brain tumor unverified,	6 "
Brain tumor suspects,	39 "
Idiopathic epilepsy,	19 "
Clinically non-tumor,	102 "
Certainly non-tumor,	52 "

(The "suspects" include all cases without a definite non-tumor diagnosis, many diagnosed merely "headache." The epilepsies may contain some actual but unrecognized tumors. The "clinically non-tumors" cover many psychosis and encephalitis cases. The "certainly non-tumors" are confined to cases of fracture and suspected fracture, and 2 cases examined to complete the study of the skeleton in Paget's disease. The "tumors" include hypophyseal growths, but exclude sarcoma of jaw invading sella, teratoma of scalp invading cranium and inspissated abscess of parietal cortex, of each one case, the two last calcified.)

Of the 15 tumors, 6 were calcified. This is 40 per cent., as against Heuer and Dandy's 6 per cent. Even if we take the percentage on a basis of all the possible tumors in the series, including idiopathic epilepsy, we get over 8 per cent. calcified. Three of them (20 per cent.) were calcified gliomata. Clarke's[12] observation of the frequency of hemoırhage confined to the tumor in gliomata may be of importance in explaining this. One case of cystic glioma in the left prerolandic region showed calcification in the right occipital lobe.

In our series were a number of other calcifications within the calvarium:

2 cases calcification in subdural hematoma.
1 case calcification in ventricular hematoma.
4 cases calcification in falx.
1 case calcification in parietal dura.
1 case calcification in pituitary (clinically non-tumor).
2 cases calcification in cerebrum, lesion unknown.
94 cases calcification in pineal.

The above are unverified roentgenologic diagnoses. There were also proved one case of teratoma of scalp in the occipital region intruding into the cranial cavity, and one case of inspissated cortical abscess.

Pineal Calcifications.—The frequency of pineal calcifications (over 41 per cent.) is noteworthy especially when compared with Heuer and Dandy's incidence of 17 per cent. I attribute this entirely to recent improvement in *x*-ray technic. Forty-five per cent. of adults (over fifteen years) in our series showed calcified pineals. The earliest appearance was in a mentally deficient girl thirteen years old in whom it was moderately dense and measured 5 x 5 mm. The largest pineal seen was in a man sixty-one years old and measured 7 x 15 mm.

Case Reports.—Case No. 7571, Mrs. L. L., forty-five years old, housewife, entered January 31, 1922 complaining of "nervous breakdown" beginning a year before, with failing vision for eight months and drooping of left upper lid for four months. She had ceased menstruation at the age of twenty-five. For twenty years she had suffered weekly attacks of vomiting, with bitemporal headache, which, however, had grown rather less severe later.

Examination showed drooping left lid and paralysis of left external rectus. Right eye showed vision 15/70, with slight defect in lower temporal field. Left eye visions fingers at 1 meter with large defect in upper temporal field and ophthalmoscopically a marked optic atrophy. *x*-Ray (Fig. 345) showed the sella expanded with eroded floor and dorsum, and calcification behind it and above the calcified pineal.

The diagnosis was pituitary tumor too large to be operable. Under monthly *x*-ray she has improved definitely, suffering but little headache and vomiting rarely. Vision of right eye is now 20/50, left 20/30, but bitemporal hemianopsia is nearly complete. Her basal metabolic rate is minus 30 per cent.

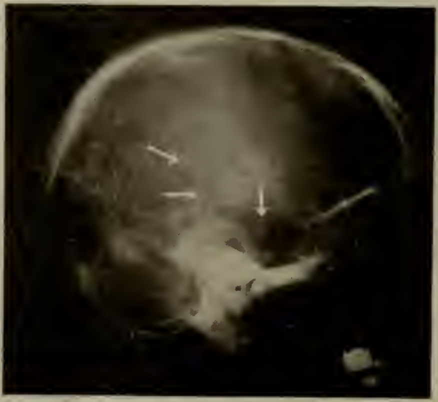

Fig. 345.—Case 7571. Extensive hypophyseal tumor with spots of calcification. The sella is deepened and its dorsum destroyed. Not verified.

Case No. 7589, Mr. A. G., thirty-two years old, a laborer, entered January 11, 1922 for herniotomy. After operation he was seen in an epileptic attack, and then a history was elicited of many major and minor attacks during the year past, sometimes half a dozen a day. He thought the left arm twitched more than the right.

Neurologic examination revealed nothing abnormal. Vision was normal, with normal eye-grounds. *x*-Ray (Fig. 346) showed a curled ribbon of calcification in the base of the right frontal lobe. Subsequent cerebropneumograms showed a normal left lateral ventricle, but air would not pass into the right, indicating obstruction of a foramen of Monroe.

He returned for operation on March 20th. The tumor was found and exposed 3 cm. under the cortex. It proved to be infiltrating and not completely removable. There was no attachment to dura under the frontal lobe.

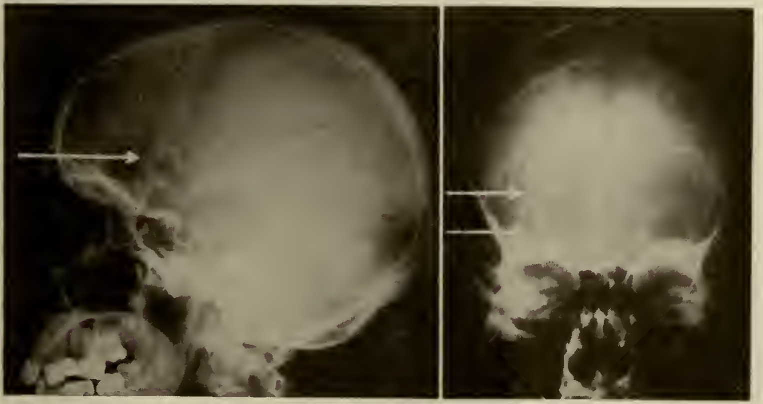

Fig. 346.—Case 7589. Glioma, calcified, of right frontal lobe. Verified by operation and microscopic section.

Microscopic examination of fragments showed glioma, partly calcified.

The patient went home April 10th in excellent condition, but suffered many petit mal and one grand mal attack in spite of luminal therapy. Since changing to bromid November 1st his attacks have ceased and he feels in good health.

Case No. 8221, Mr. C. C., twenty-nine years old, a longshoreman, entered March 16, 1922, complaining of violent headaches for a month, with occasional precipitate vomiting without nausea. The vomiting was preceded by hallucinations of smell (odor of burning hair). For a much longer period—about three years—he had suffered a grand mal attack about every three months. There had been diplopia for one month.

Examination showed bilateral choked disks, 4 D, with fair vision. No localizing nerve signs. *x*-Ray (Fig. 347) showed extensive calcifications in right frontal region and much increase in convolutional markings.

March 20th right temporal craniotomy was done. Tumor was found at a depth of ½ cm. under the frontal cortex and a small piece removed for microscopic examination, which showed infiltrating glioma. The tumor felt bony under the knife.

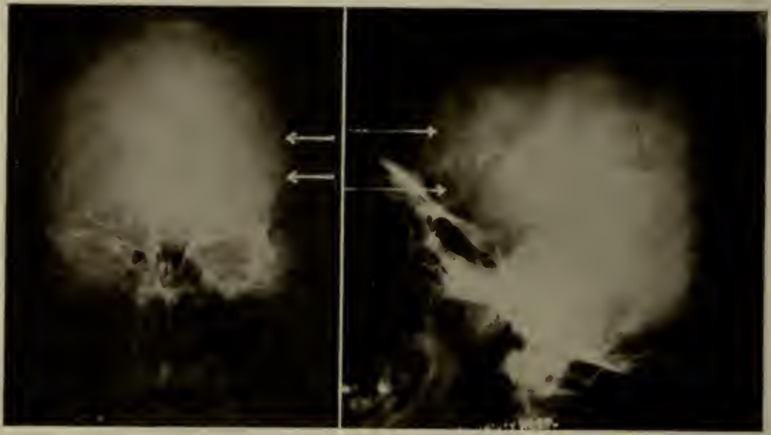

Fig. 347.—Case 8221. Glioma, calcified, of right frontal lobe. Verified by operation and microscopic section. Increase in convolutional markings.

It was intended to attempt removal at a second operation, but the patient has done so well under monthly *x*-ray treatment that this has been abandoned. His vision soon returned to normal and he has been driving a truck since July, 1922, and feels perfectly well.

Case No. 8522, Mrs. M. M., twenty-nine years old, housewife, entered April 3, 1922, complaining of severe headaches for two years, with gradual loss of vision and transient amblyopia. There had been occasional projectile vomiting.

Neurologic examination was practically negative except for almost complete blindness and bilateral choked disks of 2 D. *x*-Ray (Fig. 348) showed crescent of density in left middle fossa, and increase in convolutional markings.

Left subtemporal decompression was done April 15th. Ventricular needle met resistance at 3.5 cm. depth. Directed further back it tapped the temporal horn.

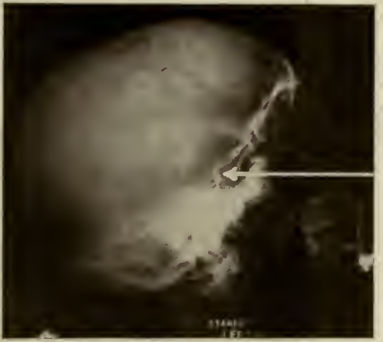

Fig. 348.—Case 8522. Large tumor in left middle fossa containing a crescent of calcification. Tumor verified at operation, but no microscopic examination obtained. Some increase in convolutional markings. Destruction of dorsum, sellæ, and posterior clinoids.

Nothing is known of patient since she went home on April 24th.

Case No. 8932, N. J., a little girl born October, 1916, began at the age of three to have spells of abstraction in the morning, with rigidity and trembling of the right arm. In January, 1921 spinal fluid was found normal, but roentgenograms showed calcification in left parietal region. Eye-grounds appeared normal. Operation was advised, but with surgeon's consent was put off. A month later neurologic examination showed bilateral Babinski and weak knee-jerks, but otherwise a normal child.

By May, 1922 the attacks of focal epilepsy had become daily events, with initial cry and twitching of whole right side, but without loss of consciousness. Neurologic examination by Dr.

W. F. Schaller showed practically nothing. x-Ray (Fig. 349) showed extensive calcification in left parietal region.

On May 3, 1922 craniotomy was done by Dr. P. K. Gilman (who has kindly permitted me to publish this case), and an extensive tumor was found, partly cystic and not separable from surrounding brain substance. Dr. Gilman considered it not removable, but took a tiny piece for microscopic examination, which showed infiltration of brain tissue by tissue containing abundant fibrils, probably a glioma, definitely not an "endothelioma."

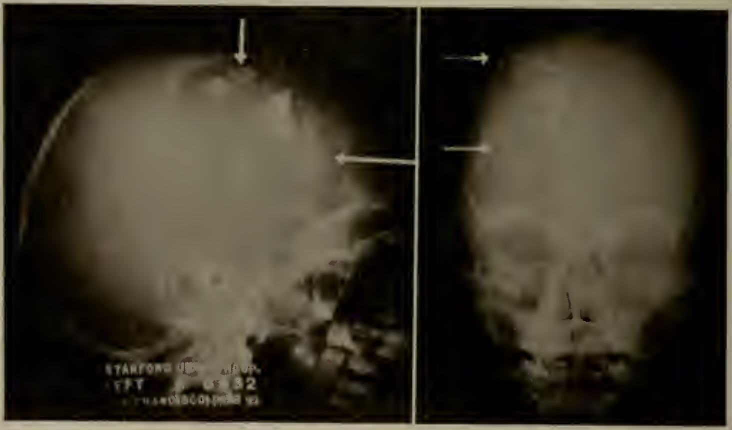

Fig. 349.—Case 8932. Glioma, calcified, in left parietal region. Verified by operation and microscopic section. Thinning of calvarium over the tumor.

Recovery was uneventful and she had only one "attack" before leaving for her home in the country May 17, 1922, where x-ray treatment begun here has been continued.

Case No. 9883, W. W., a schoolboy ten years old, entered July 3, 1922. Vision had become poor one and a half years before, and later headache and attacks of vomiting had come on.

Examination showed left-sided hemiparesis and bilateral choked disks (5 D right and 7 D on left). x-Ray (Fig. 350) showed some wavy calcification above and to the left of the sella, and increase of convolutional markings.

Right subtemporal decompression July 7th relieved headache.

Left subtemporal decompression was done July 21st. By July 31st disks had receded to about 4 D, and two weeks later *x*-ray treatment was begun. By August 18th the disks were flat and there was optic atrophy. The patient's condition grew gradually worse, however, and his parents insisted on taking him home to the country.

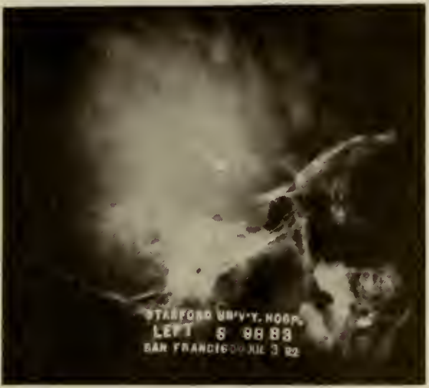

Fig. 350.—Case 9883. Tumor above sella, partly calcified, with destruction of dorsum, sellæ, and marked increase in convolutional markings. Not verified.

Two other cases deserve brief reports:

Case No. 8863, C. B., a schoolboy fifteen years old, entered April 24, 1923. He had suffered epileptic attacks, focal in right face, for a year.

Examination showed weakness of right side of face. McEwen's sign was positive 4 cm. above left auricle. *x*-Ray (Fig. 351) revealed a very small, very dense spot just inside the calvarium in the left parietal region.

The left motor cortex was exposed and the tumor could be felt just beneath it. It was easily removed and proved to be 1 cm. in diameter and 1.5 cm. long. The patient died three hours later, possibly from loss of blood. Necropsy was not obtained.

Microscopic examination showed an inspissated abscess with dense fibrous wall. Roehl's stain showed no deposition of calcium salts.

Comment: The calcified spot in the roentgenogram corresponds exactly with the location of the abscess removed. Such abscesses are frequently multiple and there may have been calcification in a near neighboring one. More likely is it, however, that the calcium in the abscess was soluble, so missed by the stain. As Heuer and Dandy have pointed out, *x*-ray sees the atom and is independent of chemical combination.

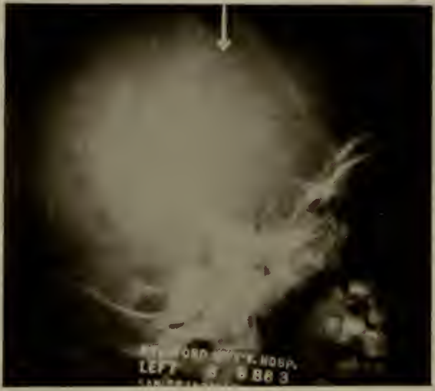

Fig. 351.—Case 8863. Calcification in inspissated abscess of left motor cortex. Verified by operation and microscopic section, except that no calcium was demonstrated by staining methods.

Case 11,648, Mr. R. L. W., a patient of Dr. T. G. Inman, who has kindly let me report the case, showed in the roentgenogram (Fig. 352) a spot of calcification above and behind a calcified pineal and several centimeters to the right of the midline. His neurologic signs, however, were accurately localizing, and at operation Dr. E. B. Towne found a cystic glioma of the left prerolandic area.

Comment: This calcification remains unexplained. The serious thing about it is that it would have been misleading if the neurologic signs had not been clear. It is a forcible reminder that roentgenograms must be interpreted in correlation with the clinical findings.

I wish to thank Dr. E. B. Towne, who operated 6 of the cases here reported, and Dr. P. K. Gilman, who operated the other 2, for their interest and assistance in this compilation.

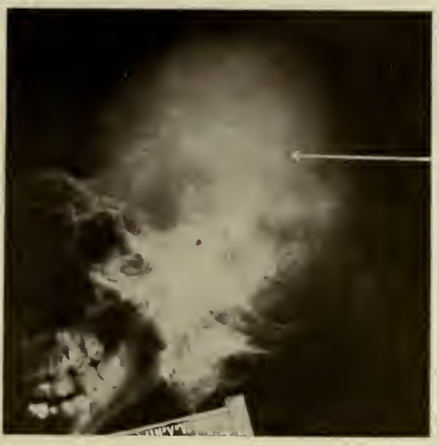

Fig. 352.—Case 11,648. Calcification in right occipital lobe in a patient in whom a large cystic glioma was found in the left frontal lobe.

Conclusions.—1. The importance of visibility in the roentgenogram due to calcification has been underestimated as a diagnostic and localizing sign in brain tumor.

2. Modern advances in x-ray technic have resulted in an important increase in the number of calcifications shown.

3. Gliomata are not infrequently calcified. Three proved cases are reported here.

4. About half of the adult population has calcification in the pineal gland.

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CLINIC OF DR. WALLACE BRUCE SMITH

University of California Hospital

NOTES ON THE PRACTICE OF PERORAL ENDOSCOPY

The progress of peroral endoscopy, a new field of medicine, has been one almost wholly of dissemination during the last decade. Killian removed the first foreign body from the trachea in 1897. Its practice at first was confined to a few who were located in areas of large population. With increasing frequency one notices reports of cases in domestic and foreign journals coming from small cities and towns not known beyond their own neighborhood. This means that the technical difficulties are being overcome by an ever-enlarging number of, as a rule, young men who are successfully practising this procedure in the communities in which they settle and start their life-work.

On account of the indications for this procedure those specialists living in small communities cannot hope to have large numbers of cases to report, or perhaps to acquire the skill of those living in the congested populated areas; nevertheless, on their shoulders (the ordinary specialist) must fall an ever-increasing number of patients who look to them for relief, and to those who see relatively few cases or to those who are in their early years of experience there must occur points of similarity in dealing with fundamental difficulties of the operation, and it is from that standpoint the following observations are discussed.

The organization of the operating-room is an essential, the importance of which is occasionally realized to the detriment of the patient. Even the most trivial details must be carried in the mind of the operator so they can be given to the head operating-room nurse with each operation. This is especially true in teaching hospitals where the personnel of the operating-room frequently changes. At times each case is new to the majority of the nurses in the operating-room.

Anesthetics.—In children the struggling which makes introduction difficult can be overcome by giving the child sufficient ether to get him completely relaxed, whereupon the introduction is easily made, and it is not usually necessary to continue the anesthetic. The child being well wrapped, foreign bodies can be discovered and removed, or cicatricial stricture of the esophagus passed with bougie before the child gets out from the anesthetic. It is hard to conceive of a child who has not experienced an operative procedure to lie quietly on the table and allow one to introduce the bronchoscope into his trachea or esophagus without protest.

Grown people who are not nervous present an easier question. A hypodermic of $\frac{1}{8}$ grain of morphin and 1/200 grain of scopolamin given one and one-half hours before operation and repeated one hour later, and patient taken to operating-room thirty minutes after the second hypodermic, is of great benefit, in which case very little cocain will be necessary even for an introduction into the trachea, and usually no anesthetic will be required when going into the esophagus.

Approach.—A great deal has been written and a great many illustrations made of the proper position of the patient for introducing the bronchoscope. There is one fundamental, however, above all others which must be observed if one is to introduce the instrument with facility and ease. When it is realized that the trachea and the esophagus do not enter the thorax in a straight line with the mouth, but that the instrument must enter in a straight line, and that it is possible by the position of the patient to acquire a straight line from the upper teeth to the esophagus, or into the trachea, a great obstacle is overcome. The patient's body must be bent forward on to the thighs, the shoulders thrown forward on to his chest, giving him the appearance of a moderate humpback, and the head extended on the neck without changing the position of the body. The patient will now be in the right position. It is of small moment whether the patient is lying on his back, or left side, or sitting in the chair.

The primary position of the body as described above will make the introduction easy and possible in any of the three positions mentioned. As a matter of fact, it is almost impossible to introduce the instrument without first acquiring this position.

Once in the trachea or esophagus, the main indication is to discover the indicating lesion, whether it be foreign body or new growth. As a rule this is very easy with foreign bodies, save perhaps locating a pin with the point up. Difficulties are encountered, especially in such case where the object is located on the left side where the cardiatory movement interferes with the fixing of the vision, and again, in cases of foreign bodies located in the middle lobe of the right lung.

The grasping forceps that come with any bronchoscope set will prove satisfactory with most foreign bodies. If there is a fault in grasping the foreign body, it is more apt to be either the incorrect position of the patient or the lack of skill on the part of the operator than the instrument.

In some cases recourse to a hook will be found expedient, as, for instance, the larger end and attached stem of a rusty collar button—a button such as is sometimes used in laundries to close the front of the collar band. This object was in the right lower lobe secondary bronchial tube, big or flat end up, and completely filling the lumen of the bronchial tube. It appeared to be an impossible maneuver to get the jaws of a grasping forceps over the big ended bottom without injuring the mucous membrane, so a hook was used and easily passed beyond the foreign body, turned 45 degrees, and the button fetched into the lumen of the instrument and so removed. In another case, the half of a parched peanut, which also filled the lumen of a secondary bronchus, recourse was had to the hook for fear of injuring the mucous membrane and of perhaps crushing the peanut, thereby giving us many instead of a single foreign body. The result was quite as satisfactory as in the case of the collar button. It is always advisable after the foreign body is located to note its position and discover the narrower as against the wider measurement of its presenting part, so that the jaws of the forceps can be adjusted before being introduced. If the forceps are so constructed as not to permit of this, the operator compensates for it by the position in which he holds his arm; this is best exemplified in cases of coins and buttons, leaves, peanut hulls, etc.

Complications.—To know the complications which may arise from a pathologic condition or a surgical procedure, and to avoid them successfully when possible, or treat them when they have established themselves, is as essential as the knowledge of the pathologic condition itself or the necessary skill to carry on the surgical procedure.

When the peroral endoscopy has to do with the respiratory tract we have mostly to do with complications arising from mechanical causes, and this is confined mainly to swelling of the soft subglottic tissue producing temporary obstruction to respiration which can readily become dangerous to life. This complication occurs more frequently in children and babies. On the part of the operator, either unskilled introduction of the bronchoscope, a tube relatively large, or too frequent introduction, at one séance, or keeping the tube in the trachea for too long a period are causes which produce this distressing state of affairs—for such it really is indeed.

On the part of the patient we may have inflammation extending down from the larynx and up from below, such as an intercurrent laryngitis or tracheitis, bronchitis as caused by colds, etc., or the foreign body itself in foreign body cases, can have traumatized the subglottic area, either in its passage to lower regions or by its having lodged in the neighborhood. However, in cases where there was no definite notice made of a pathologic subglottic swelling at the time of introduction it must be considered as due to the instrumentation, and it must be remembered that there is no field of surgery where dexterity and skill are so potent for good and where the opposite contains the possibilities of so much harm.

In a series of foreign body cases covering the writer's experience of ten years this complication has occurred twice. The first was the case of a three-year-old girl who had aspirated a small blue-headed beauty pin while playing in the yard with her sister, April 17, 1917. She was seen in the hospital eleven days later. Pin was located on the left side, secondary bronchial bifurcation, lower lobe, sharp end up. Pin was considerably influenced by the cardiac motion, so that it was difficult to discover its sharp upper end. The tube was in thirty minutes altogether. Two days later patient's breathing was difficult; a direct laryngoscopy was done, condition diagnosed, and a tracheotomy performed. Patient left the hospital ten days later, tracheotomy tube having been out two days. This complication can be accounted for in the length of the time of instrumentation.

The second, that of a nine months baby who had aspirated a piece of dead leaf, on the margins of which were small sharp spines, like a holly leaf. It had remained in the trachea for twenty-four days and the child's general health condition was run down. It was easily seen and removed, duration of instrumentation not over six minutes, with a tube which was easily introduced. Seven hours later respiration became labored, and when seen thirty minutes later was in a critical condition. A vomiting spell choked the air off altogether, and an emergency tracheotomy was performed in the ward, patient cyanosed and limp. As soon as the trachea was opened the stormy symptoms disappeared and the little one left the hospital ten days later, cannula out, wound almost closed, and general condition approaching normal. She was seen a couple of months afterward fully recovered.

The first case can be accounted for in that the instrumentation lasted thirty minutes. It is hard to concede in your own case that a six-minute instrumentation in a nine months child should be sufficient to produce subglottic swelling. The case was an easy one, presenting no difficulties.

When the peroral endoscopy has to do with the esophagus the arising complications are those of infection from previous traumatisms, either from the lesion that necessitates the examination, foreign body, or from the instrumentation.

One would like to doubt that there were even an occasional endoscopist who could be so ungentle or unskilled as to injure the esophagus. There has been enough written, and it has been written with sufficient frequency, and the information has been made so accessible, for there to be no excuse for ignorance of the delicateness of the esophagus and the serious consequences following injury. "Surgically more intolerant than the brain" is the expression used by the foremost practical endoscopist in the short history of this field of medicine. Withal, however, there still are many sad results from forays of overenthusiasts into this viscus. More often than his own errors the endoscopist is brought in to witness the havoc wrought by the family physician or surgeon who blindly tries to remove foreign bodies with probangs or forceps—usually a long uterine forceps—or who try to dilate a friable carcinomatous stricture with a bougie or stomach-tube. An illustrative case will make the point clear.

A lumberjack was brought into the University of California Hospital Thursday, August 11, 1921, who had gotten "choked" on the wishbone of a frying-sized chicken the Sunday before. He consulted a physician the day following the choking, who made repeated attempts with a probang either to pull out or push down the chicken bone. On admission to the hospital he was in a bad state—pulse 122, respiration 35, and temperature 104° F. with a peculiar sweetish foul odor to his breath, great pain and prostration, emphysema around lower part of neck in front and upper part of thorax. The expression on his face and the whole manner of him was of one *in extremis*. The Roentgen ray was negative. With the expectancy of exitus at any moment the patient was put on the operating-table, the bone found 25 cm. from the upper teeth, and removed. The keeled end had cut through the esophagus and trachea a little to the right of anterior; the shorter of the separated ends was free in the esophagus, the longer had penetrated through the esophagus into the peri-esophageal, mediastinal tissues, and on both ends firmly attached were some half-dozen bristles of the probang.

It is improbable that the force exerted by the esophagus on anything it may temporarily contain is sufficient to drive a bone of the size of the one in question through its own wall and the wall of the trachea, on the one hand, and through its own wall and into the mediastinum, on the other. That it ultimately does occur through traumatism, infections, and ulceration there can be no doubt, but not in four days.

The patient died five hours after leaving the surgery. Would the patient have died had there been no blind attempts at removal?

The future of peroral endoscopy must carry some similarity to historically earlier difficult surgical procedure, as the process of dissemination mentioned above would already seem to indicate. The number of those qualifying as endoscopists will multiply many fold, the procedure will become better known, perhaps simplified, and its benefits taken advantage of by internists and surgeons. Blind groping in the esophagus for foreign bodies by surgeons, or the equally unscientific attempts to dilate carcinomatous structures by internists has already, let us hope at least, disappeared from the medical faculties of the teaching institutions, and will soon be regarded by all medical men of training as a condemned procedure relegated to a past generation.

CLINIC OF DR. ALFRED BAKER SPALDING

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RUPTURE OF THE UTERUS AFTER OPERATION FOR UTERINE SUSPENSION

Suspension of the uterus during the child-bearing age is so frequently performed that an experience of rupture of the uterus in labor following such an operation is deemed worthy of report.

On July 10, 1921 I was called to see a patient at 11.30 P. M. who had been under an anesthetic for one and a half hours because her attending physician had been unable to deliver her by attempted forceps and attempted version and extraction. The labor had started at 6 P. M. on July 9th. The membranes had ruptured at 9 A. M. on July 10th. At 9 P. M. the attending physician stated that he could not feel the cervix by vaginal examination, so called his brother in consultation. The second physician found the cervix high above the promontory of the sacrum. He pulled this down and, finding the cervix dilated, attempted to apply forceps. He could apply only one forcep, however, because of the difficulty of introduction. He then attempted version, which was unsuccessful. The result of the attempted version caused the cord and arm to prolapse into the vagina.

On examination at 11.30 P. M. I found the cord prolapsed and pulseless, with the right arm presenting into the vagina. The promontory of the sacrum was projected forward. The child was lying in occiput left position. The presenting part lay in a cap formed by the anterior wall of the uterus. The posterior wall was indefinite. Some thick tissue seemed to be interposed between the baby's leg and head. There was no fetal heart heard. The patient's pulse was 130, temperature normal. She was flowing rather freely of bright red blood. It was judged impossible to deliver the patient by the vagina and the patient was sent to the operating-room for laparotomy.

On opening the abdomen I found about a cup of free blood in the abdominal cavity. The anterior wall of the uterus was adherent to the lower part of an old abdominal scar by a band as thick as the forefinger. This band was severed and a large amount of adhesions in the neighborhood of the right adnexa were separated from the anterior abdominal wall. The uterus was found to be ruptured posteriorly at the vaginal junction so that the baby's arm and cord, which had been felt by vaginal examination, projected into the abdominal cavity (Fig. 353). The round ligaments were clamped with difficulty and the bladder separated from the front of the uterus. The right broad ligament was clamped below the adnexa because of damage due to the adhesions. The left adnexæ were left in the abdomen

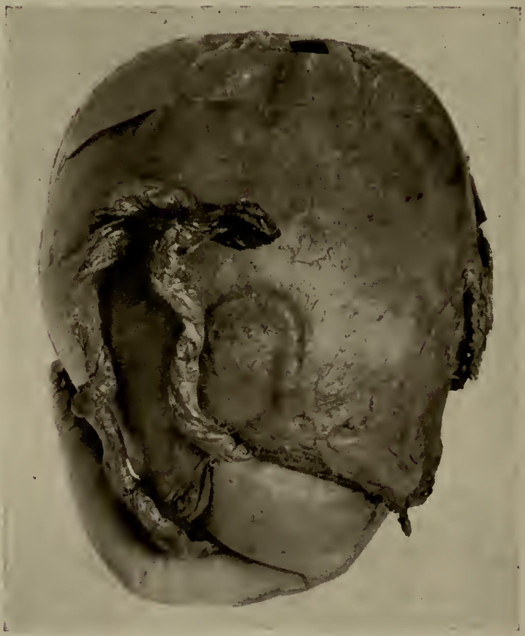

Fig. 353.—Showing kolporrhexis with prolapse of right arm and cord.

and the uterus was amputated at the site of rupture, without opening, as the baby was dead. The vagina was closed and the round ligaments with the ovarian stumps were sutured to the cut edge of the vagina. This area was covered with the peritoneal reflection of the bladder. The abdomen was closed in layers. The patient left the table in good condition, having been under the anesthetic for several hours, that is, from the time the attending physician had first attempted to apply forceps.

The patient made an uneventful recovery, the pulse dropping from 130 to 90 by 4 o'clock on the day of operation. The highest temperature during her convalescence was 100.4° F., registered the first day postpartum. The patient left the hospital in good condition on July 20th, with a pulse of 96, a temperature of 98° F., and respiration of 16.

The following history was obtained from her attending physician:

The patient was twenty-six years of age, gravida III, para II. Her last baby was born in May, 1918, by forceps delivery. She was operated on in May, 1920, when some form of uterine suspension was done. There was evidently no intention to do a fixation, but the operation had been followed by a peritonitis as the uterus was firmly adherent to the abdominal wall along the line of incision and the right side of the abdomen. Her last period was September 25, 1920, which made the labor due, according to Nagel's rule, about July 2, 1921. Throughout pregnancy there had been considerable nausea and some abdominal pain, otherwise her condition was normal. Her pelvic measurements were normal.

The above case report serves to illustrate the bad prognosis for pregnancy following fixation of the uterus to the abdominal wall. The literature on this subject is very extensive, and so often has this fact been mentioned that it is hardly conceivable that one would now intentionally fix the uterus to the abdominal wall for a woman during the child-bearing period. On the other hand, the great frequency with which the operation is performed and the great variety of technic advised, seems to point to the fact that altogether too frequently the uterus becomes unintentionally fixed in operations designed merely for the purpose of suspension.

The uterus is found to be retroverted in about one-fourth of all patients examined, and seems to be rather more frequent with young women than with women near the menopause, in spite of the fact that parturition increases the number of retroversions. Many of these retroversions produce no symptoms until the time the patient becomes pregnant. Then there is undoubtedly an increased danger that the patient may miscarry about the third month from failure of the uterus to spontaneously replace itself. In my experience it is seldom the sole cause for sterility, and replacing the uterus with the idea that pregnancy will follow is frequently disappointing.

In the class of young patients who suffer with pelvic inflammatory disease, the incidence of retroversion of the uterus is markedly increased. For instance, following the examination of 500 girls in the Ventura Reform School in California, the resident physician reported that 75 per cent. showed pelvic inflammatory disease, and 50 per cent. retroversion of the uterus. With these patients undoubtedly the symptoms complained of were due more to the inflammatory condition than to the mechanical displacement.

From an examination of 300 consecutive confinements in Lane Hospital we found an incidence of 44 per cent. of retroversion of the uterus, which gives an increase over the precentage found in non-pregnant patients. In my private practice many patients with postpartum retroversions have been permanently cured not only of an acquired retroversion, but of a congenital retroversion by the proper and persistent use of a well-fitting pessary postpartum. And frequently the patient so treated has been found after a second confinement with the uterus in normal position.

Where vascular changes have taken place so as to produce pelvic varicocele we have found that a Gilliam uterine suspension gives the best chance for permanent relief of symptoms, particularly if the sacro-uterine ligaments are shortened at the same time.

These facts have caused me practically to limit the indications for replacing the uncomplicated retroversion of the uterus by operative means to those patients who suffer with the symptoms refereable to varicose veins in the broad ligaments. That these ideas do not meet with the practice of the profession in general is illustrated by the fact that in one month, out of 631 gynecologic operations posted by the Academy of Medicine[1] in New York City, 133, or 21 per cent., of the operations were for retrodisplacements or prolapse of the uterus.

In 1919 Emge[2] reported our clinic experience with 33 full-time labors following various types of uterine suspension and fixation. Of 11 operations performed in the clinic, 5 by Webster technic, 3 by Gilliam, 1 by Kelly-Neel, and 2 by Coffey technic, there were 11 spontaneous labors, although one was rather long and severe. Since then we have 14 labors after suspension to report which have resulted in 12 spontaneous labors, 1 cesarean section, and 1 high forceps. Therefore, out of a total of 25 labors following uterine suspension without fixation, there were 23 perfectly normal labors. This probably fairly represents the experience following such a suspension of the uterus as is recommended by Olshausen or Gilliam, or some of the many modifications of this operation.

Contrasted to this is clinic and consultation experience with 44 labors following operations for uterine suspension where the type of operation was unknown. In this group there were 29 spontaneous labors including 1 case of breech extraction and 1 of low forceps operation. There were 3 cesarean sections, one hysterectomy for rupture of the uterus (reported above), 7 high forceps, 3 versions, and 1 craniotomy. In other words, serious dystocia has occurred in over 34 per cent. of these patients previously operated upon for retroversion of the uterus.

With this group of patients there was also an increase in the fetal mortality due to operative interference, and one mother died two weeks after cesarean section from an infected hematoma of the right broad ligament. Several patients suffered at the time of labor from various forms of hemorrhage, including separation of the placenta and placenta prævia. However, the most serious complication met with was the case of rupture of the uterus reported above.

In conclusion, it is interesting to note the statistics of Weber[3] who called attention to the fact that in the Münchner Frauenklinik the percentage of uterine ruptures had increased from 1 in 1476 labors previous to 1899, to 1 in 697 labors since 1899. He attributes this increase in the number of ruptures to injuries to the uterus caused by previous operations, particularly to injuries caused by curettage in the puerperal period. Of 28 ruptures during this operative period, one was through an old cesarean section scar. Fixation of the uterus to the abdominal wall is an additional factor that predisposes to rupture of the uterus following operation upon women during the child-bearing period.

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CLINIC OF DRS. W. W. BOARDMAN AND P. K. GILMAN

From the Medical and Surgical Clinics, Stanford University Medical School

CHRONIC CHOLECYSTITIS SIMULATING GASTRIC MALIGNANCY

In the great majority of cases, with our present means of diagnosis, it is possible to be reasonably certain of recognizing organic disease of the stomach and duodenum and to differentiate it from chronic gall-bladder disease. However, we have recently had 2 cases and, through the courtesy of Dr. Stanley Stillman, can report a third, in which the above does not hold true. These cases, judging from a casual survey of the literature, including George and Leonard's "The Pathological Gall-bladder," appear to be unusual in that definite radiographic evidence of an organic defect of the stomach was demonstrated (Figs. 354, 355), which at operation proved to be caused by pressure of an enlarged gall-bladder and surrounding adhesions.

CASE REPORTS

Case I.—Mr. C. G. (No. 100,185) American, aged fifty-three years. Elevator operator. Married.

Complaint.—Loss of appetite, stomach distress after meals, belching, loss of weight, and weakness. Duration fifteen months.

Family History.—Unimportant.

Past History.—General health very good. Acute infectious diseases, severe diphtheria 1920. Operations, tonsillectomy August, 1921 under general anesthesia.

Head and Neck.—Negative except for chronic tonsillitis and several abscessed teeth recently removed.

Chest.—Negative.

Gastro-intestinal.—Appetite always good and patient a large eater up until present trouble. Absolutely denies previous gastric distress, belching, and regurgitation. Bowels regular.

Urinary and Venereal.—Negative.

Skin.—Negative.

Nervous System.—Negative.

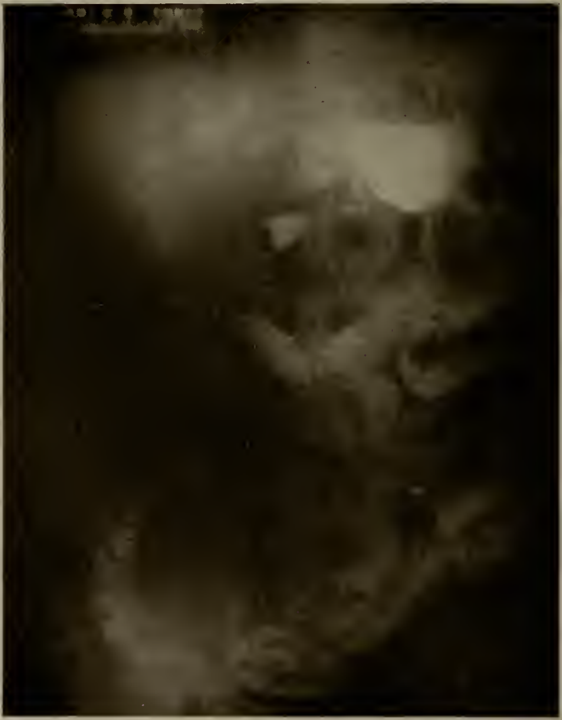

Fig. 354.—C. F. G., showing large defect of the pyloric antrum, found at operation to be due to enlarged gall-bladder and adhesions and not to carcinoma.

Habits.—No excess. Tobacco none. Alcohol moderate. Works hard and sleeps well. Average weight 150 pounds.

Present Illness.—Patient dates the onset of his present illness about two years before admission. It began by the regurgitation of rather large and increasing quantities of clear sour fluid a short time after each meal. This was preceded by distress in the upper abdomen, belching, and distention, all of which symptoms were temporarily relieved by the bringing up of this fluid.

These symptoms persisted and later were accompanied by loss of appetite, weakness, and a rather marked loss of weight.

Four months before patient's admission his chronically inflamed tonsils were removed on the theory that they might be the cause of his weakness, digestive disturbances, and loss of weight. However, following this procedure, the patient's symptoms were aggravated rather than relieved. It then became necessary for the patient to restrict his diet, eliminating certain articles of food and limiting others, especially meat. Still later any but a moderate amount of food increased his distress. Recently patient has been constipated and suffering from hemorrhoids.

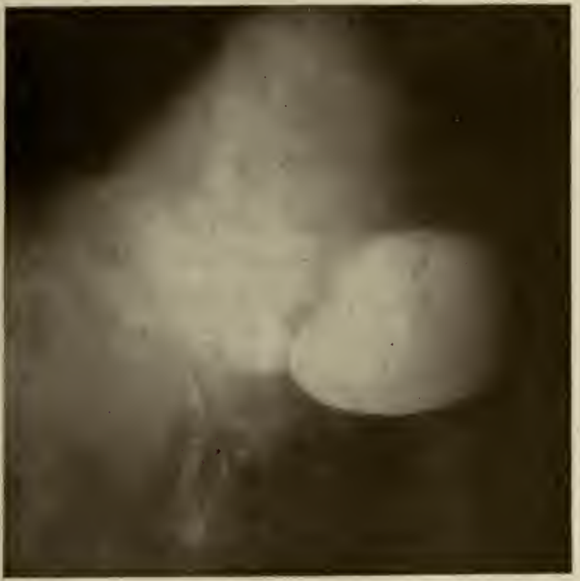

Fig. 355.—J. C., showing irregularity of pyloric zone and large defect of antrum, found at operation to be due to adhesions and not to carcinoma.

One week prior to his admission to the hospital the patient was examined by one of us, the examination being negative except for general appearance, evident loss of weight and weakness. *x*-Ray examination on this occasion showed on repeated examination a persistent widening of the pyloric interspace somewhat more marked on the lesser curvature with about one-quarter residue at six hours. A test-meal revealed subacidity without occult blood. As a result of these findings patient was advised to enter the Medical Clinic of Stanford University Medical School for further study and probable operation for pyloric carcinoma.

Re-examination in the hospital disclosed the following:

Head and Neck.—Negative.

Chest, Heart, and Lungs.—Negative. Blood-pressure, 140/80.

Abdomen.—At this time a fulness was distinctly seen in the upper half of the right upper quadrant. This area was dull to percussion and on palpation a nodular mass 5 to 6 cm. in size was felt, extending downward to within two fingerbreadths of the umbilicus and to the left as far as the midline. This mass moved with respiration, was not attached to the abdominal wall, and could be grasped with the examining fingers. The liver edge was made out just below the right costal margin. There was no muscle spasm, but some tenderness over the mass. There was no tenderness in the region of the appendix. Rectal examination was negative.

Extremities.—All reflexes were present and equal.

Laboratory Examinations.—Urine: Negative.

Blood.—Red cells 5,800,000 with but 75 per cent. hemoglobin. White cells 6900, leukocytes 62 per cent., lymphocytes 34 per cent., and 4 per cent. transitionals. Wassermann negative with all antigens.

Gastric Analysis.—Fasting content, total acidity 7 per cent.; no free hydrochloric acid. Fractional meal clear, straw-colored fluid one-half hour total acidity 7 per cent., no free HCl; one hour same; one and one-half hours total 10 per cent., no free HCl. Microscopic examination was positive for Oppler-Boas bacilli. No occult blood.

x-Ray Examination.—Stanford University Hospital, *x*-ray Department.

Name: Mr. C. G., Medical Clinic, Medical Ward. November 9, 1921.

Region: Gastro-intestinal.

The capacity of the stomach is diminished so that it is distended in appearance by less than the usual 14 ounces of barium mixture. The stomach is held very high up in the abdomen beyond the reach of palpation, save in the region of a palpable mass which corresponds with a large filling defect of the antrum. Beyond the filling defect a small piece of antrum is seen, bounded on one side by the defect and on the other by the pylorus. The duodenum appears normal.

At six hours there is marked hypermotility, the head of the barium column having reached the splenic flexure, with ileum almost empty.

The patient did not return for the twenty-four-hour observation.

Conclusion: *x*-Ray evidence of a large tumor mass of the gastric antrum.

In view of the above findings by the hospital staff the patient was referred for operation with the independent diagnosis of carcinoma of the stomach.

Operation November 10, 1921.

The abdomen was entered through a midline incision between the ensiform and umbilicus.

On exploring the viscera the pylorus was found thickened and looked edematous, but no thickening suggesting carcinoma was found, the walls of the stomach and duodenum being otherwise apparently normal.

The gall-bladder was next inspected and found to be enlarged to about 7 cm. in diameter and 12 cm. long. Its walls were thickened, opaque, and under considerable tension, suggesting a fairly recent acute distention. In the region of the gall-bladder and cystic duct the wall of the viscus was considerably more thickened and surrounded by numerous adhesions to the omentum. The regional glands were enlarged. The gall-bladder was removed.

The appendix was found to be diseased and was also removed.

With the definite widening of the pyloric interspace noted in the radiographic examination of November 2d in mind, and with the thickening and edema found in the region of the pylorus, exploration of the inner surface was decided upon. An incision 3 cm. long was made in the stomach wall near the pylorus, the latter being everted and inspected through this opening. In appearance the mucosa was normal and the opening was closed.

The postoperative course was uneventful barring a bronchopneumonia. The patient left the hospital four weeks after operation in good condition free from his previous gastrointestinal symptoms.

Since leaving the hospital his condition has steadily improved until at present he has entirely regained his weight and strength and suffers from no digestive disturbance.

Radiographic examination done February 20, 1923, more than fifteen months after operation, showed some persistence in the original defect due to adhesions, as with pressure the defect could be filled out and normal appearing rugæ traced entirely across this area.

Comments.—The findings a week before patient entered the hospital of persistent widening of the pyloric interspace with delay in emptying of the stomach and subacidity led to a diagnosis of carcinoma of the pylorus. The hospital findings of a palpable mass and a large defect of the lesser curvature with anacidity likewise led to a diagnosis of gastric carcinoma by these other observers. In spite of the discrepancy of these findings they led to a similar diagnosis. In our opinion this discrepancy was at least partially explained by an increase in the size of the gall-bladder subsequent to the first examination resulting in the palpable mass and an exaggeration of the gastric defect.

Case II.—J. C. (No. 104,224), American. Aged sixty-two years.

Complaint.—Stomach trouble of eight months' duration.

Family History.—Unimportant.

Past History.—Unimportant except for herniotomy in 1919.

Present Illness.—Perfectly well up to July, 1921, when, shortly after a heavy meal, he was taken with sudden severe abdominal pain associated with nausea and vomiting. The pain was dull, felt throughout the abdomen, but was somewhat more marked in the epigastrium. This attack persisted for three weeks, during which time no food and little liquid was retained.

The vomitus consisted of large amounts of greenish fluid. Belching was a prominent symptom.

Following this attack patient remained quite well until two weeks before admission (March 30, 1922), when he was again taken with abdominal distention, epigastric pain, and vomiting. There was no loss of weight.

Physical Examination.—*Head.*—Negative except for marked dental sepsis.

Chest.—Lungs emphysematous. Heart enlarged in transverse diameter. Sounds faint and irregular. No pulse deficit. Blood-pressure 110/75.

Abdomen.—Uniformly distended. No masses felt, no shifting dulness; no tenderness.

Extremities.—Negative.

Laboratory Examinations.—Urine negative.

Blood Wassermann negative.

Stool negative except for occult blood.

Test meal, fasting content 25 c.c. greenish fluid with dark green finely divided sediment. Total acidity 22 per cent., no free HCl. Occult blood positive. Fractional test-meal showed maximum total acidity 11 per cent., no free HCl in any specimen.

x-Ray examination March 3, 1922.

The stomach is high and tonic and shows fair peristalsis. Under the screen it is not seen to empty, but the films show a small amount of barium in the duodenum and jejunum. The outline of the stomach is smooth. There is a defect of the antrum about 3 cm. from the pylorus. The duodenal cap is never outlined, but in one of the films is seen to contain a very small amount of barium. At five and a half and seven and a half hours and again at twenty-four hours there was evidence of barium retention in the stomach.

Conclusions.—Organic lesion of the pylorus with marked delay in emptying.

In this case the history does not suggest carcinoma, but in view of the patient's age, achylia, evidence of an organic lesion at the pylorus with twenty-four-hour delay, and the absence of ulcer history, exploration for a possible pyloric carcinoma was advised.

Operation April 8, 1922.

The stomach was exposed through a midline incision above the umbilicus and was found so distended a tube had to be passed to empty it.

The stomach and duodenum were negative except for a large band of adhesions about the pylorus reaching from the great omentum to the gall-bladder. The gall-bladder was markedly inflamed and surrounded by adhesions. The pyloric end of the stomach was pulled up by these adhesions and the duodenum displaced down by the very fibrous and short omentum, with a resulting kink in the duodenum and another in the colon. The gall-bladder was freed from adhesions and removed, and the other viscera returned to normal position.

The postoperative course was complicated by an auricular fibrillation and terminal pneumonia.

Comments.—In this case an unexplained pyloric obstruction coupled with patient's age and an achylia raised the question of maligancy requiring exploration to rule it out.

Case III.—This case is reported through the courtesy of Dr. Stanley Stillman. Complete records are not available, having been destroyed in the fire of 1906. This case was treated previous to the days of *x*-ray diagnosis.

American, male. Age fifty-five years.

Complaint and History.—Indigestion and stomach trouble accompanied by pain and vomiting. Almost continuous vomiting for a month preceding admission, associated with constant pain in the region of the pylorus and rapid loss of weight. No jaundice or any history suggesting gall-stone colic. Diet restricted to liquids.

Examination.—Cachexia, emaciation.

Abdomen.—No palpable tumor. Stomach lavage showed twelve hours' retention. This case was regarded as one of carcinoma of the pylorus, with obstruction and operation advised.

Operation.—At operation the pyloric end of the stomach was found to be much thickened and many thick fibrous adhesions were found involving the gall-bladder, duodenum, and pylorus. The gall-bladder was found to be shriveled to the size of one's thumb and filled completely full of small flat stones not particularly faceted. There was nothing to suggest carcinoma of the stomach. The gall-bladder was torn open during the operation and many of the small stones escaped, but the wall of the bladder did not bleed, nor was there any bile or mucus to be found present; it was excised, after separating it from the pylorus and duodenum, to which it was bound by thick and tough fibrous adhesions. Abdomen closed and the wound drained. Patient died within forty-eight hours of the operation.

An autopsy was done, at which it was found that the wall of the stomach at the pyloric ring and even the wall of the duodenum contained a number of small flat stones similar to those found in the gall-bladder, which had traveled between the muscularis and the mucosa of the stomach and of the duodenum, and had progressed as much as $\frac{2}{3}$ inch from the pyloric ring. The obstruction of the pylorus was found to be due to edema and cicatricial tissue resulting from the migration of the stones.

Comment.—In this case, as shown at operation and autopsy, there was an organic defect of the pyloric antrum and duodenum secondary to inflammation of the gall-bladder with stones. This deformity would undoubtedly have been demonstrated by *x*-ray examination and have presented a difficult problem for diagnosis.

Conclusions.—1. An enlarged gall-bladder and adhesions may produce a filling defect in the stomach at times indistinguishable from that produced by gastric carcinoma.

2. It would appear from the above that no matter how definite and advanced a case of gastric carcinoma appears from the history, examination and laboratory findings, short of metastases, an exploratory operation is indicated.

CLINIC OF DR. EDWIN I. BARTLETT

University of California Hospital

MESENTERIC CYSTS

The first 2 cases represent rare types of an uncommon tumor. Less than 200 instances of mesenteric cysts have been recorded in the literature to date, while the records of the University of California Hospital for the past five years yield but 2 cases among 1572 laparotomies.

Case I.—Cyril C., white, male, schoolboy, eleven years old, was admitted to the University of California Hospital on June 24, 1919, complaining of abdominal distress and loss of appetite. The family and past histories were negative except for the usual children's diseases and frequent attacks of sore throat. For the last five years he had been a normal, healthy boy.

The initial indication of the present illness was irritability, first noticed about four months previous to his admission. About ten weeks later a "bilious attack" followed the eating of "questionable food." There was nausea and considerable pallor, but no fever or localized pain. Quick recovery followed the administration of cathartics and restriction of diet. A similar attack, except for a fever of 101° F., coming on five weeks later or four days before admission, and treated in a similar manner, seemed to be gradually clearing up when during the night of the third day a sharp aching pain in the right abdomen awakened the patient out of a sound sleep. After an hour or two of ineffectual use of the usual home remedies the pain was largely relieved by firm pressure over the right abdomen and the patient again fell asleep. In the morning there remained some nausea and a slight dull, non-radiating, aching pain throughout the right abdomen.

Examination showed a rather pale, well-nourished boy, about twelve years of age, with a tendency to guard his movements and to walk slightly doubled over to the right. His temperature was 37.8° C., pulse 120, respirations 25, white blood-count 10,500, urine negative. His general physical examination was negative except for the abdomen, which showed uniform distention, tenderness over the whole right half, especially near the umbilicus, board-like rigidity of the right rectus and oblique muscles, and a suggestion of dulness far out on the right flank. Rectal examination was negative. Position or effort had no effect on the symptoms.

In spite of a low leukocyte count and a normal temperature the sudden flare-up of symptoms after a gastro-intestinal up-set, associated with rigidity and tenderness of the right abdomen, was interpreted to mean an inflammation of the appendix, and the abdomen was explored for the purpose of appendectomy.

The peritoneal cavity was opened through a McBurney incision. On inserting the finger a mass was discovered filling the whole right flank and pushing the colon well over toward the medial line. The appendix was definitely injected, but there were no adhesions or exudates, though there was considerable more clear fluid in the peritoneal cavity than is usually found. The wound was enlarged upward by following the right border of the rectus, and lateralward by cutting the muscles. Incision was made through the peritoneum at the outer border of the cecum and ascending colon, mobilizing the right colon and uncovering a huge, black, lobulated, cystic tumor filling the whole right retroperitoneal space. By blunt dissection enucleation was begun, but almost immediately one of the larger cysts ruptured and several ounces of straw-colored fluid welled up into the wound. The wall of the cyst proved to be of paper thinness, the inner surface was smooth and shiny, and apparently devoid of lining epithelium. A trocar was inserted in several directions until drainage was sufficient to decrease the size of the tumor by about one-half, and then enucleation was completed without further accident. The tumor extended from the liver to the brim of the true pelvis, and from the point of presentation in the right flank to the root of the mesentery alongside the vertebral column. The main attachment of the tumor proved to be at the under side of the mesentery of the right colon and cecum. At this point and again at the junction of the first and second portions of the duodenum sharp dissection with the knife had to be employed in order to separate the tumor from the vessels without injury to these structures. No fragments of the tumor were left behind, though the cystic cavities at the mesenteric attachment were extremely small and the capsule of the tumor was very indistinct. The lymphatic glands in the overlying mesentery of the colon were markedly enlarged, varying in size from ½ to 3 cm. They were very pale and were finely bosselated like coarsely pebbled leather. The cut surface of one of these glands resembled hyperplasia in the gross, and the frozen section showed no primary or secondary tumor. The remaining glands were undisturbed. The operation was concluded by suturing the rents in the mesenteric peritoneum, suturing the posterior

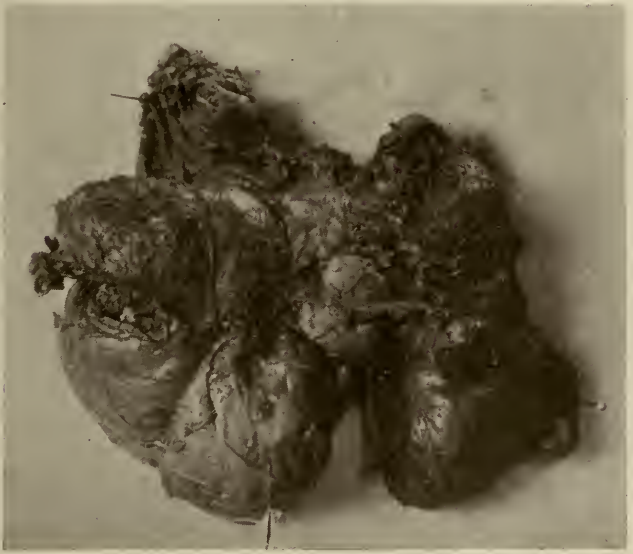

Fig. 356.—Lymphatic cyst. Note extreme thinness of walls with gauze packing showing through. (Case I.)

parietal peritoneum, and placing a cigarette drain in the retroperitoneal space. The patient's condition was sufficiently good to justify appendectomy, so the appendix was removed. The wound was closed by the usual procedure. Patient was under ether about two and a half hours. There was no shock.

The patient had an uneventful recovery and was discharged on the sixteenth day with a sinus draining a very slight amount of clear fluid. Healing of the wound was complete by the thirtieth day. His immediate postoperative course was complicated by the usual amount of abdominal distress from gas, and a very mild degree of nausea. His temperature was 40° C., on return to the ward, but by the sixth day was normal. It is now three years since operation, and the patient is apparently healthy and normal in every way.

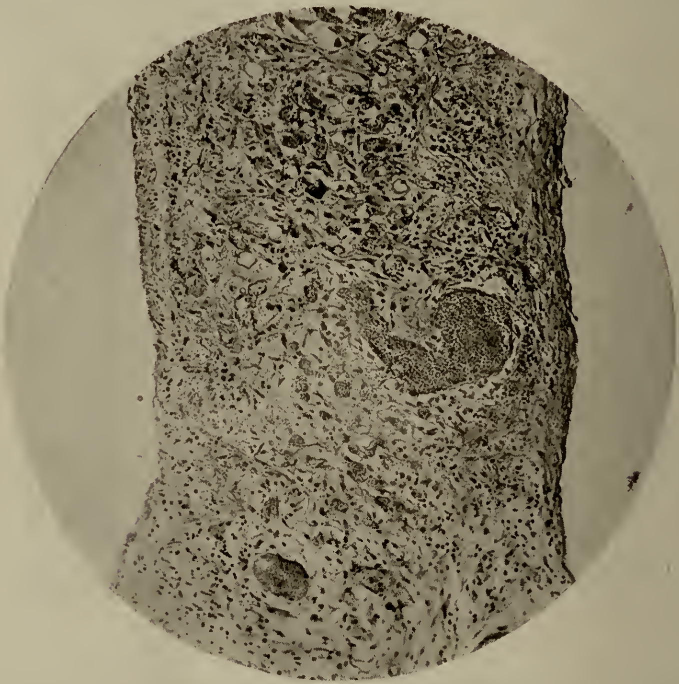

Fig. 357.—Wall of lymphatic cyst showing partition between two cavities. Note numerous and large thin-walled blood-vessels and round-cell infiltrations. (Case I.)

The gross specimen (Fig. 356) was a multiloculated cyst, measuring about 17 cm. in greatest diameter. The cavities varied from 10 cm. across to microscopic, were filled with a serous or slightly blood-tinged fluid, and lined by a shiny surface. The walls were thin, edematous and delicate, and traversed by numerous, large thin-walled blood-vessels. A second specimen consisted of a lymph-gland about 1 cm. in diameter, the cut surface of which was glistening, succulent, and a mottled grayish pink.

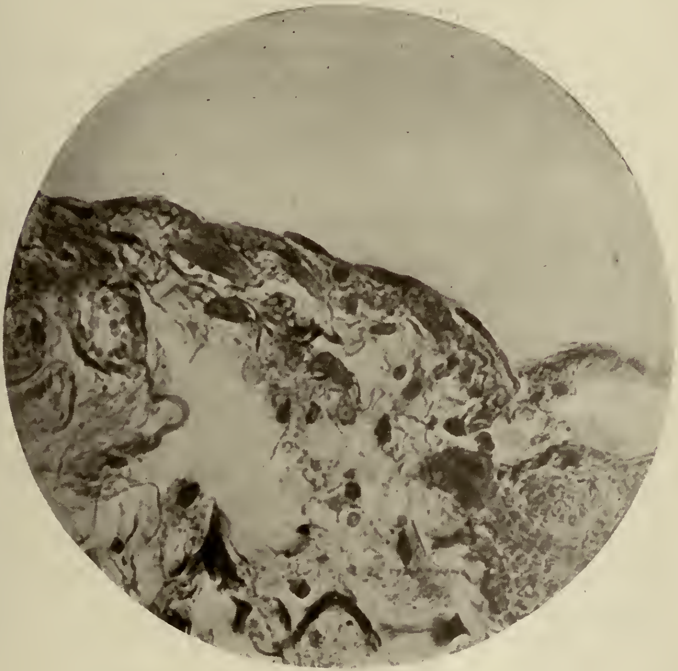

Fig. 358.—Lymphatic cyst wall under high-power magnification to show endothelial lining. (Case I.)

Microscopically the walls of the cysts (Fig. 357) were thin and composed of a cobweb like, deeply pink staining connective tissue poor in nuclei and moderately infiltrated with patches of small round cells mixed with infrequent groups of polymorphs. Occasionally in the smaller cysts one made out an endothelial lining, but the larger cavities were quite uniformally bare (Fig. 358). The blood-vessels were numerous, rather large, and without walls except for the endothelial lining. Differential stains failed to show any smooth muscle. Sections from the lymph-gland showed an entire disappearance of all the germinal follicles with an enormous dilatation of sinusoids. There was no endothelial hyperplasia.

Final Diagnosis.—Lymphatic cysts.

Case II.[1]—Edgar L., white, married, laborer, forty-four years old, was admitted to the University of California Hospital on April 17, 1922, complaining of pain in lower abdomen and back. His family and past histories were negative except for pruritis ani, from which he had suffered for years.

The present illness dated back to about September 1, 1921, eight months before admission, when he first noticed a sense of fulness and uneasiness in the lower abdomen. In December 1921, four months later, he had cramp-like "gas pains" across the lower abdomen, continuing intermittently for about a week, and uninfluenced by position, food, condition of the bowels, etc. Following this attack the sense of uneasiness and weight increased, but pain was absent till February, 1922, six months after the onset, when he began having acute, sharp, stabbing pain starting in the left lower quadrant and traveling across to the right side. The patient had never noticed any swelling of the abdomen nor had he noticed anything unusual about his stools until shortly before admission, when he recognized blood-clots in one stool following a treatment for pruritus ani.

Examination showed a well-developed, well-nourished, middle-aged man with negative general physical examination and with normal findings in gastric analysis, urine examination, kidney function test, blood Wassermann reaction, and complete blood-count. The abdomen was slightly protuberant, especially in the lower, left quadrant, where a firm, definite, slightly movable, non-tender tumor mass could be felt. Pulsation was made out, but its expansile character could not be agreed upon. Barium studies under the fluoroscope were negative for evidence of bowel obstruction. Cystoscopic examination revealed no connection between the tumor and the genito-urinary system.

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[1] Reported through the courtesy of Dr. Saxon T. Pope.

A positive clinical diagnosis was not attempted in the face of these negative findings, so the abdomen was explored under a variety of tentative diagnoses. His symptoms were attributed to partial obstruction of the bowel.

Incision through the lower left rectus muscle exposed a large, bluish-black, firm, rounded, non-pulsating mass approximately 6 inches in diameter situated between the two leaves of the peritoneum in the mesentery of the ileum. It lay immediately against the bowel wall for some distance and caused some narrowing of the lumen, but no definite or even partial obstruction. The bounderies of the tumor were sharp on all sides, there were no secondary growths, no enlargements of the neighboring lymphatics, no peritoneal implantations. Resection was performed and followed by anastomosis.

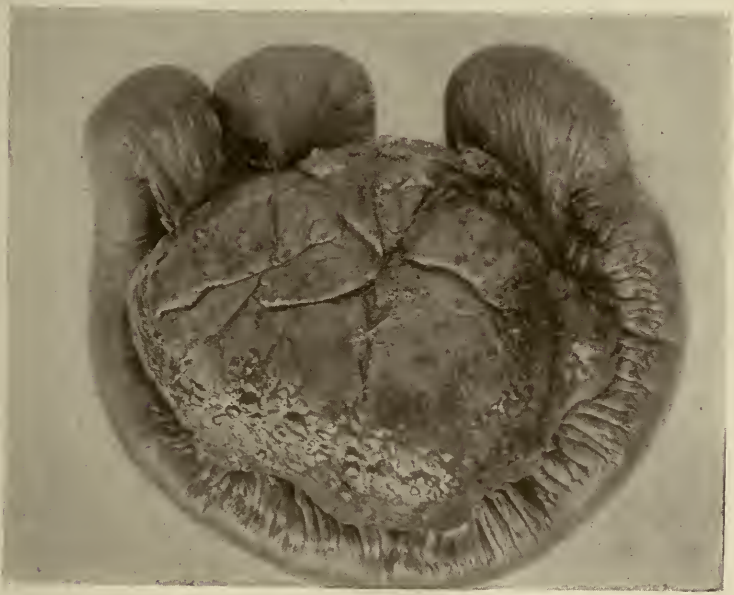


Fig. 359.—Hemangeomatous cyst in the mesentery of the ileum. Note tough warty surface. There is no narrowing of bowel lumen. (Case II.)

The patient's postoperative course was entirely uneventful, he was discharged as well on the fifteenth day after operation, and is free from symptoms and is in good health today.

The gross specimen (Figs. 359, 360) showed a roughly spheric, firm, deep purplish-red, encapsulated mass, measuring 100 cm. across; the outer surface of which was tough and warty, much like a toad's back. A loop of small bowel partly encircled the tumor and the mesenteric peritoneum covered two opposite surfaces. A slice, taken off one side, revealed a multitude of cavities, ranging from 1 cm. across down to microscopic. Each was filled with a very dark bloody fluid and was lined by a tough shiny membrane. Probing of the cavities demonstrated intercommunication or outlet except in the largest.

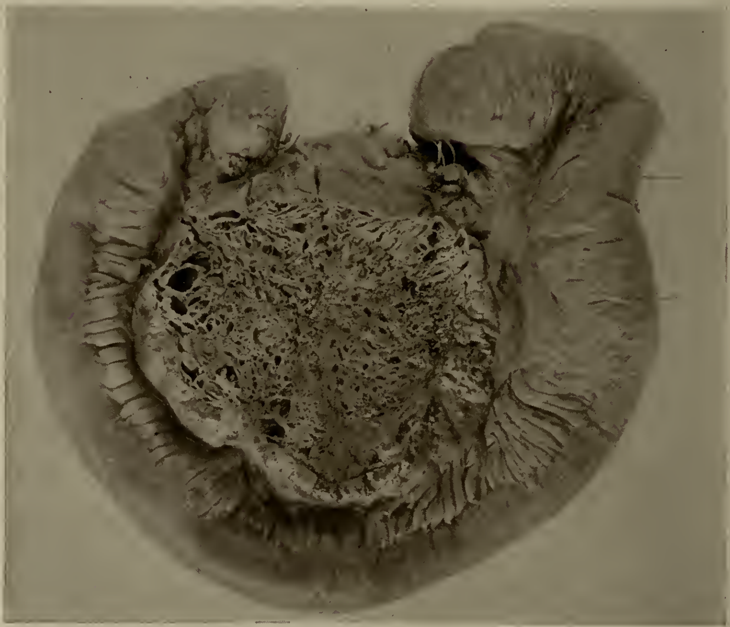


Fig. 360.—Slice taken of one side of hemangeomatous cyst to show cavities. The fluid escaping from the surface when cut was made gave same differential blood-count as patient's blood from the ear. (Case II.)

Microscopic section (Fig. 361) showed a very definite endothelium similar to that in the blood-vessels lining all the smaller cavities and a great number of the larger cavities. The intervening supporting connective tissue was delicate, quite acellular, stained a deep pink, and was moderately infiltrated with patches of small round cells. Differential stain and careful search failed to reveal smooth muscle or other structure than those described.

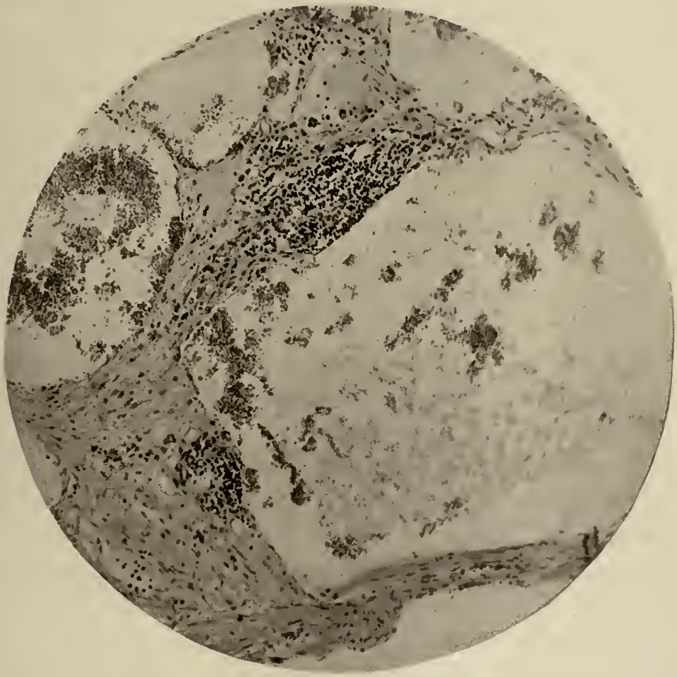


Fig. 361.—Low-power magnification of smaller cyst cavities and partitions between. The lining is continuous endothelium. Note patches of round cells. (Case II.)

Final Diagnosis.—Cystic hemangioma.

Mesenteric cysts are unilocular or multilocular, thin or thick walled sacs, filled with a serous, sanguineous, chylous or mucinous fluid, or with a dermoid material and located in the omentum or between the leaves of the mesenteric peritoneum of the small bowel or behind the peritoneum and vessels of the large bowel. Cysts of the pancreas or other internal organs, malignant tumors which have become cystic through degeneration, and infectious cysts are not properly included under this heading.

The origin of such tumors, in the majority of instances, is from the embryonic anlagen of the primitive sex organ, the wolffian body, or the omphalomesenteric duct. Occasionally they may arise from the abdominal lymphatic cistern or from angiomas of the blood or lymphatic vessels or from dermal inclusions. The structure, as seen by the microscope, varies with the origin. High columnar epithelium and pseudomucin suggest the pseudomucinous cyst of the ovary and demonstrate a primitive-sex-organ ancestry; primitive glomeruli in the walls prove an origin in the wolffian body; smooth muscle and epithelial lined spaces show a relationship with the intestinal tract; endothelial lining and serous contents in a retroperitoneal cyst point to an origin in the lymphatic cistern or in a lymphangioma. With the exceptions of the mucoid secretion of the pseudomucinous cyst and the blood of a cystic hemangioma, the type of fluid is of no significance, it having been demonstrated that chylous or bloody fluid results from rupture of lacteal or blood-vessels in the cyst walls.

The symptoms are invariably those of obstruction, though occasionally they seem to point to appendicitis. In none of the instances reported was the clinical diagnosis correct, and for the most part the true condition was not even suspected. The treatment of choice is resection or enucleation, though marsupialization has been followed by a cure. Recurrence may follow incomplete removal and death may result from obstruction, but metastasis does not take place, and patients do not die of malignant toxemia because these tumors are benign.

The first case of our series is lymphatic and arose from the abdominal cistern or developed from some abnormality of the lymphatics of the mesentery to the right colon. In support of this contention the microscopic structure is similar to that of the second case except for the scantiness of the endothelial lining, and is exactly like that of a huge, multiloculated, axillary lymphatic cyst removed from another patient. The absence of lining cells as a result of pressure is shown in many of the cases reported, and in the axillary cyst just mentioned, which could have had no other than a lymphatic origin, the larger cavities were all bare. That such tumors may arise from the abdominal cistern has been pointed out by Sabin, who has demonstrated the origin of similar cyst of the neck in the jugular cisterns.

The second case is hemangioma which has become cystic through the shutting off from the general circulation of some of the larger cavities.

MIKULICZ'S DISEASE

Mikulicz's disease is a painless, non-sensitive, bilateral enlargement of one or more pairs of lacrimal or salivary glands resulting from a replacement of normal salivary gland substance by an overgrowth of lymphoid tissue.

Case III.—Manuel S., white male Portuguese; truck driver, thirty-one years old, was admitted to the University of California Hospital August 16, 1920, complaining of swelling of the face. He had always been well except for an attack of bilateral mumps complicated by double orchitis at the age of twenty-one. He recovered satisfactorily from the mumps and for two years was apparently as well as before. Eight years before admission his parotid glands again began to enlarge. The swelling was painless, gradual, without remission. There were no associated salivary irregularities, such as excessive salivation or dry mouth. At times when he had a bad cold the glands were tender to touch. There was no history in his family of similar trouble.

When the patient first visited the clinic there was marked bilateral parotid enlargement about equal on the two sides (Figs. 362, 363). The surface of each swelling was smooth, the edges were fairly sharp, the consistency was elastic, fairly soft, and semifluctuant. In contour each enlargement was the shape of normal gland, though in actual area covered it was many times larger. The overlying skin was freely movable and apparently normal. The parotid ducts were huge, the walls flabby, the openings widely patent. Close observation during the use of various sialagogues showed a total absence of secretion. The remaining salivary glands and the lacrimal glands were apparently unaffected. The general appearance of the patient was that of robust health and the general physical examination was negative. There were no lymphatic glandular enlargements, either local or general; the spleen was not enlarged; the blood-count and blood-smears were normal; the urine examination was negative; the von Pirquet tuberculin test was negative, both human and bovine. The tentative diagnosis was Mikulicz's disease.

Exploratory operation was performed August 19, 1920. Incision through the skin and subcutaneous tissues exposed a normal appearing gland capsule, and division of the capsule and gland substance as far as the posterior surface revealed a succulent, grayish-white, glistening, friable tissue not resembling in any way the parotid gland, but rather suggesting an edematous lymph-node. Throughout were frequent cysts ranging from 1 to 3 mm. in size. Some of these were spheric, most of them were tubular or irregular, all were closed sacs without communications with the main ducts or with each other. The contents of the cysts were a cloudless and colorless fluid, like water. A small piece was removed from the depths for microscopic study and the wound was closed without drainage. Healing resulted without suppuration.

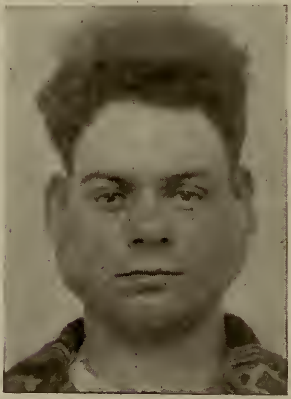


Fig. 362.—Photograph of a patient with Mikulicz's disease involving the parotids. (Case III.)

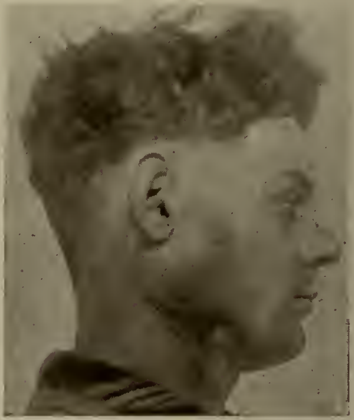


Fig. 363.—Side view of the patient in Fig. 362 to show limits of swelling. (Case III.)

Microscopic studies showed the typical picture of Mikulicz's disease (Figs. 364, 365). The salivary gland structures were entirely lacking except for an occasional atrophic duct. The gland substance was replaced by small lymphoid cells, distributde evenly throughout a barely demonstrable, delicate reticulum. Here and there were small patches of larger cells, in morphology and arrangement resembling somewhat lymph-follicle cells.

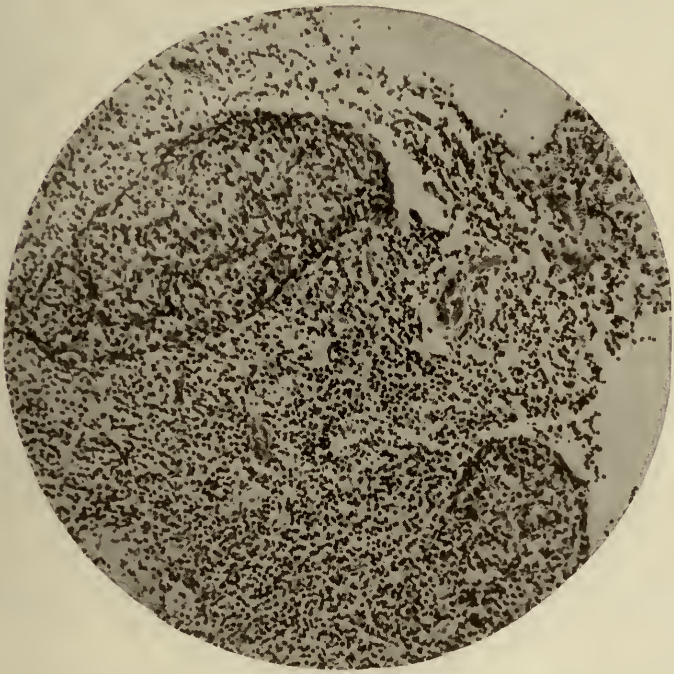


Fig. 364.—Higher power of Fig. 365 showing nests of larger lymphatic cells. (Case III.)

The patient was referred to the Radium Department, where radium emanation tubes were inserted into the depths of the swelling by means of a hollow needle. Six millecuries in five tubes were buried in the right side and 6 millecuries in four tubes in the left side. Within a week there was a perceptibe decrease in the size of the glands, and by the end of four weeks they were about one-third their original size. There was some breaking down of gland substance with liquefaction, and at several points the skin sloughed. After eight weeks the face had resumed its original shape and the only evidence of a pathologic condition were the scars of the radium burns (Fig. 366). For two and a half years the patient has been free from recurrence, with the exception of acute swelling simulating acute parotitis coming on about six months after his first treatment. The left gland very suddenly began to swell, became painful and tender, and the skin over the surface became red and edematous. Within two hours of the first indication the swelling had reached its maximum size and the pain had become so severe as to prevent sleep. In the skin there was one spot redder than the rest, and fluctuation at this point was so suggestive that incision was made. The gland substance was quite like that observed at the original exploratory; no pus was found. Treatment with hot

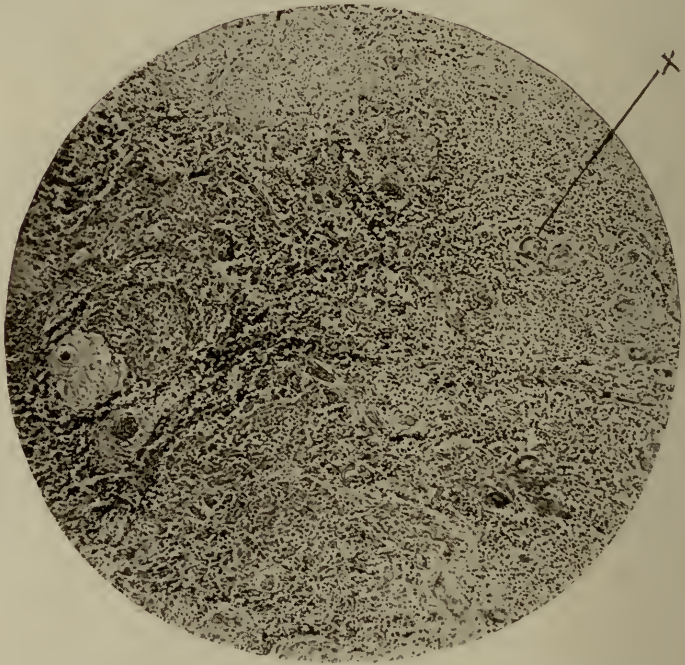


Fig. 365.—Low power of Mikulicz's disease showing the lymphoid stroma replacing the parotid gland parenchyma: X, Atrophic salivary ducts. (Case III.)

towels was instituted and by the end of forty-eight hours the pain had entirely disappeared, the tenderness was largely absent, and the swelling was practically gone. After an interval of about three or four days, or approximately one week after the beginning of the swelling on the left side, the right gland became swollen. Potassium iodid was given in large doses, hot towels were applied, and the swelling rapidly subsided. By the end of the tenth day after the second attack the face had resumed its normal appearance and there was no more tenderness or pain.

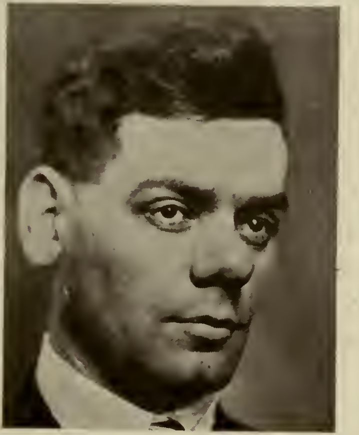


Fig. 366.—Photograph of patient shown in Fig. 362 taken two months after radium treatment. (Case III.)

The first case was reported by Mikulicz in 1888, and several additional instances were reviewed and discussed in his Thesis four years later. Since his time a large number of cases have been reported under the name of Mikulicz's disease. In 1909 the whole subject was exhaustively reviewed by Campbell Howard, who collected from the literature and classified all the cases reported as Mikulicz's disease up to that date. Out of the 81 cases which he collected and those that have been subsequently reported, about one-fourth are authentic or genuine, in that the data is sufficient or the conditions described are without complications.

Pathology.—The original case described by Mikulicz had symmetric and bilateral swellings of the lacrimal, parotid, submaxillary, sublingual, palatal, and accessory salivary glands. A liberal translation of his pathologic findings is as follows: The submaxillary glands which were removed *in toto* and which were swollen to the size of a child's head conformed exactly to the proportion of the normal glands with regard to lobes and lobules. In the coarser macroscopic details the tumor showed the normal structure of the gland only immeasurably enlarged. Nevertheless upon making a fresh cross-section a substantial difference in the color and in the finer structure of the gland parenchyma forming the individual lobules was apparent even to the naked eye. Instead of the finely granular, grayish-red structure of the normal gland parenchyma we see a more homogeneous, pale, reddish-yellow, bacon-like mass of some transparency. The number of blood-vessels seem to be increased only in septa, corresponding to the increase in the size of the organ. The substance of the gland itself appears strikingly poor in blood-vessels. The microscopic examination showed that the main tumor mass consisted of a uniformly arranged tissue of small round cells. The cells lie in groups close together or in other places a delicate reticulum can be recognized between. Larger isolated cells show plainly many nuclear divisions. In these small-celled masses there seemed to be embedded sometimes singly, sometimes in groups, the apparently unchanged acini of the salivary gland. They are forced apart to a certain extent by the round-celled tissue.

The pathology among the cases reported as Mikulicz's disease has often differed from that described by Mikulicz, and in these instances the term has been employed as meaning the clinical phenomenon of bilateral salivary or lacrimal swelling. Such conditions as leukemia, pseudoleukemia, tuberculosis, syphilis, and non-specific inflammation, in which there has been salivary or lacrimal enlargement, have been included. Some of these have shown fibrosis, inflammation, or caseation in the midst of a more or less abundant parenchyma, while others that have had more nearly the pathologic picture of Mikulicz's disease have shown general disease of the same type in the blood or other parts of the body. Such cases should not be included among the reports of Mikulicz's disease, but rather should be classed with the constitutional diseases represented.

Treatment.—The complicated cases have improved under treatment or resulted fatally, according to the type of complicating condition and the degree of amenability to treatment of that particular disease. With the improvement of the general health in response to hygienic measures tuberculous enlargements have often subsided; under administration of antiluetic drugs there has been complete relief in syphilitic cases; in the leukemias and other fatal conditions the tumors have gone down under treatment that has favorably effected the disease proper. On the other hand, true cases of Mikulicz's disease have neither died of their disease nor shown impairment of general health. A few have cleared up spontaneously and some have recovered while under treatment. Regarding the latter, the actual benefit from the measures employed has been questioned, inasmuch as no therapeutic agent has as yet been discovered which has yielded a cure in more than one case. This unreliability of the regularly employed agents, arsenic, potassium iodid, *x*-ray, etc., has prompted experimentation with radium, and the gratifying effects, from the standpoint of freedom from accompanying local or general disturbance as well as the perfect cosmetic result, recommend its future trial.

CLINIC OF DR. EDMUND BUTLER

San Francisco Hospital

COMPOUND POSTERIOR DISLOCATION OF ELBOW

This twelve-year-old Russian boy has just arrived in the ambulance. The Steward informs us that the boy fell over a cliff and the large bone of the left arm is sticking through the skin, and that there has been very little bleeding. The Steward cut the coat sleeve, covered the wound and protruding bone with a sterile gauze dressing, and applied a well-padded posterior splint before attempting to transport the patient. The boy is not in shock and does not complain of any great amount of pain. There is very little bleeding, inasmuch as the dressings are not blood-stained.

Making slight traction on the hand, the circular bandage holding the splint is cut and the dressings removed. As you see, the inferior extremity of the humerus is protruding from a lacerated wound of the anticubital region (Fig. 367). The end of the humerus has been stripped of all ligaments and muscular attachments, but not of the periosteum. The external epicondyle has been sheared off.

Our interest is now centered on the condition of the nerves, tendons, and blood-vessels at the elbow-joint. Sensation is present in all parts of the hand and forearm and there is no paralysis. Therefore we know that the ulnar, radial, and median nerves have not been damaged. The hand and fingers are slightly cyanotic, but the finger-nails blanch with pressure, and the temperature is only slightly lower than that of the other hand.

In such an injury you would certainly expect the median nerve and the blood-vessels to be injured to some extent. A palpable pulse in the radial artery is absent. If you look closely you will see that the brachial artery has been completely severed and the proximal end is protruding and pulsating in the superior part of the wound. There is no bleeding from the torn artery.

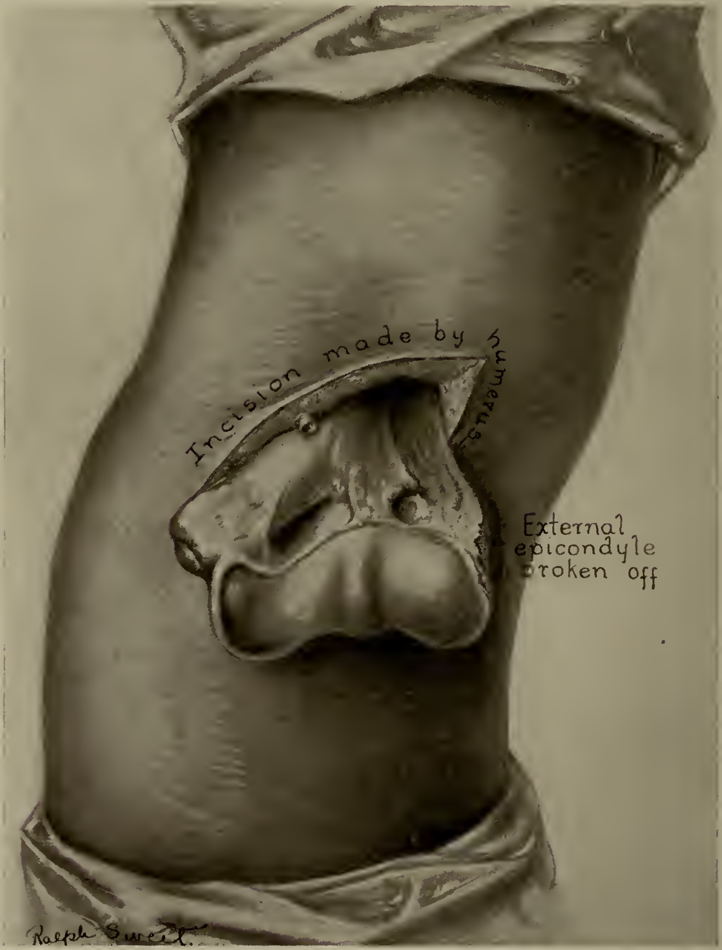


Fig. 367.—Compound posterior dislocation of elbow before reduction.

The skin hugs closely around the shaft of the humerus laterally and inferiorly, so we are unable to see what has happened deeper in the wound.

Gas and oxygen anesthesia: Covering the exposed bone with sterile gauze, the skin of the arm and forearm is shaved, scrubbed with ether and with alcohol, and painted with a 5 per cent. alcoholic solution of picric acid. We shall now excise the margins of the wound, including the skin and fascia, and any fringes of fascia or muscle that present.

There is no macroscopic contamination of the exposed bone, therefore we are going to irrigate the articular surface and adjoining exposed periosteum with a stream of warm sterile normal salt solution for at least ten minutes, being careful that the solution does not enter the wound. We believe it is far better to get rid of possible infection and microscopic particles of clothing and filth by irrigation than by attempting to render them innocuous with iodin or picric acid solutions or other bactericides, which in themselves cause a slight inflammatory reaction in any wound, particularly a wound partially lined with synovial membrane.

It is our opinion that there has been no contamination of the depths of this wound, so there is no reason for attempted sterilization of the deeper portions.

With narrow retractors the angles of the wound are retracted and elevated. The torn, clotted brachial artery is ligated with No. 1 plain catgut. As we make extension the tendon of the biceps slips around from behind the external condyle, and the median nerve slips from behind the internal condyle. The dislocation is easily reduced.

The belly of the brachialis anticus has been completely torn across near its insertion. We will not attempt to suture it, as we believe that any instrumentation or manipulation in this wound is likely to introduce infection. Scar tissue will fill in between the torn ends, and possibly a fairly well-functioning brachialis anticus muscle will result.

We are going to be satisfied with this simple open reduction and make no attempt to repair the lateral ligaments. The head of the radius is held in its proper relation to the ulna by the unruptured orbicular ligament. The margins of the wound fall together and no sutures are necessary.

We put this elbow in a compress of normal salt solution, being careful not to cause the slightest constriction. We do not expect much bleeding if any. The wound is large and any exudate may easily escape.

In what position do we wish this arm retained? If we flex to an angle of 90 degrees, the tone of the biceps muscle will tend to dislocate the head of the radius anteriorly, so we put the arm either in a position of about 45 degrees of flexion or 150 degrees of flexion, so that the pull of the biceps will be more longitudinal. We believe the position of 45 degrees is better because there will be less tension on the soft parts surrounding the elbow, and the collateral circulation will be less embarrassed. A molded posterior plaster splint will hold the arm in that position.

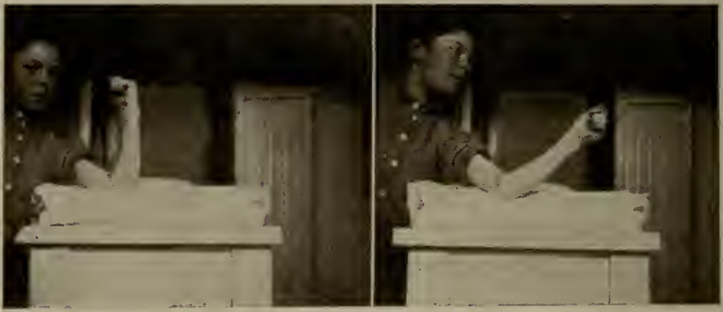


Fig. 368.—Active flexion (left); active extension (right) six weeks following injury.

The compresses are to be changed daily. An immunizing dose of tetanus antitoxin is to be administered within twenty-four hours.

If this patient were beyond middle age we should expect some circulatory disturbance distal to the torn brachial artery, gangrene, or other nutritional disturbance of a less extent in the skin, muscle, and bone. The elbow is surrounded by a very excellent collateral circulation. Anteriorly we have the branches of the anastomotica magna artery above and the radial and recurrent arteries below. Posteriorly we have the branches of the anastomotica magna and the inferior branches of the profundæ arteries above, and below the ulna recurrent artery and the interosseous recurrent artery.

On the sixth day the radial pulse was palpable.

On the tenth day passive motion was begun.

Discharged from the hospital on the seventeenth day, 15 degrees of active motion present. Primary union of wound.

Plaster dressings removed at the end of six weeks. Condition of arm (Fig. 368). Present condition (Fig. 369).

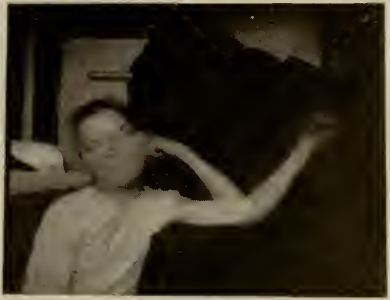


Fig. 369.—Active flexion and extension at end of nine weeks.

We are in no great hurry to get complete extension of the elbow. In a position of complete extension great strain is exerted upon the lateral ligaments; this we hope to avoid.

The sudden complete tearing of the brachial artery in the region of the elbow-joint, with only the slightest transitory ischemia distally, is a fact worthy of recording.

TORSION OF SPERMATIC CORD, GANGRENE OF TESTICLE WITHOUT TRAUMA

Patient, aged thirty-five, entered Mission Emergency Hospital one-half hour ago.

This man has always had a tender movable mass in the left groin near the spine of the os pubes. The left testicle is absent from the scrotum.

Four days ago patient first noted a throbbing pain located in this movable mass, and the mass suddenly became tender. Pain increased Tuesday, and considerable swelling was noticed. There is absolutely no history of any gastro-intestinal disturbance. Bowels moved well this morning. No history of any venereal infection. At present his temperature is 100.4° F. rectally. There is a leukocytosis of 12,500, 82 per cent. polys. Examination of urine is negative. Rectal examination negative.

This is not a picture of an inguinal adenitis. There is no evidence of any infection in the region drained by the inguinal glands, rectum, genitalia, or left limb. The history is not that of a strangulated hernia involving gut, although an appendices epiploicæ originating from the sigmoid becoming incarcerated and later strangulated, might give this picture. There is no history of injury that would lead us to suspect a traumatic orchitis. The absence of venereal infection would eliminate the probability of epididymitis. This condition apparently has to do directly with the undescended testicle. It came on suddenly and grew gradually worse, although the pain at present has somewhat lessened.

The history and course of the symptoms leads us to suspect that something has happened to interfere with the circulation of the testicle.

Gas and oxygen anesthesia: Incision parallel to Poupart's ligament, over the most prominent portion of the inguinal mass. The superficial fat is slightly edematous. As the aponeurosis of the external oblique muscle is cut a sac under tension, filled with dark colored fluid, bulges through the incision. A small opening is made in the sac and a considerable quantity of bloody transudate escapes. This small opening is enlarged and the sac, the distended tunica vaginalis, contains the testicle, which is bluish black in color (Fig. 370). The tunica vaginalis is not reflected from the testicle, but completely envelops the testicle and is reflected from the cord about 1½ cm. superior to the testicle. There are two complete twists to the left in the cord,

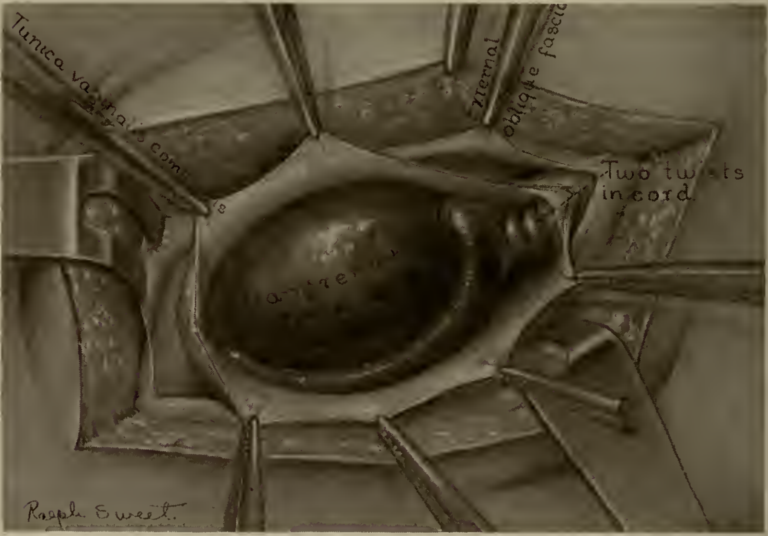


Fig. 370.—Gangrenous undescended left testicle in inguinal canal.

these twists taking place within the tunica vaginalis. All the vessels are thrombosed, as there is no change in color when the cord is straightened. Ligation of the cord high up, superior to the reflexion of the tunica vaginalis. Cut end of cord retracts within the internal ring. No hernial sac is encountered. Testicle and tunica vaginalis ablated. Conjoined tendon, internal oblique muscle, and transversalis muscle sutured to Poupart's ligament throughout. Aponeurosis to external oblique closed completely.

Postoperative course of this case was uneventful.

Patient discharged thirteenth day—well.

The finding of gangrene of the testicle coming on spontaneously from torsion of the cord and testicle within an abnormally large tunica vaginalis is very unusual, and, in my opinion, warrants the making of this report.

CLINIC OF DR. GEORGE WARREN PIERCE

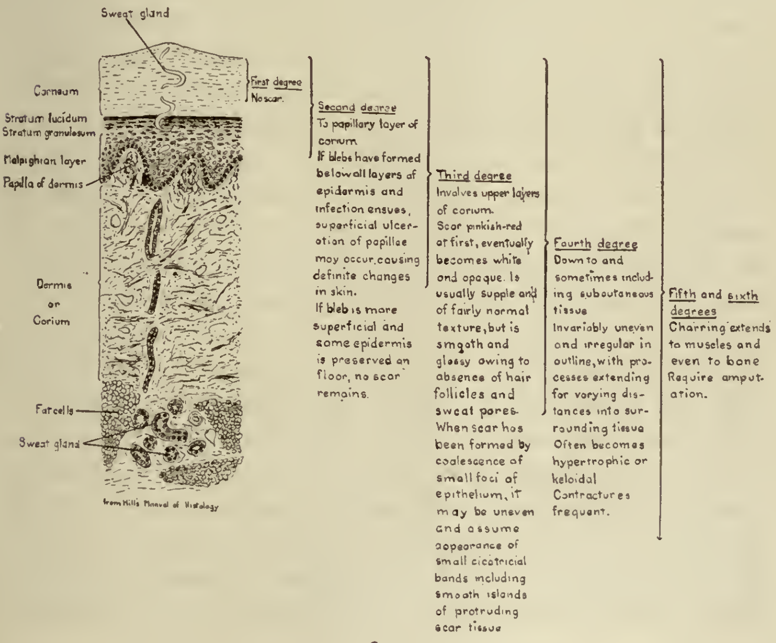
St. Francis Hospital

SURGICAL TREATMENT OF BURN SCARS

The treatment of scars from burns presents many difficulties to the surgeon, yet much can be done by plastic surgery to relieve the cosmetic and functional deformities. Accurate knowledge of the tissue loss and of the principles and possibilities of plastic surgery will enable one to offer to such patients improvement in appearance and relief from contractures.

The following outline, with the accompanying chart, will refresh the memory as to the structure of the skin.

Section of skin showing degrees of burns.



First degree
No scar.

Second degree
To papillary layer of corium
If blebs have formed below all layers of epidermis and infection ensues, superficial ulceration of papillae may occur, causing definite changes in skin.
If bleb is more superficial and some epidermis is preserved on floor, no scar remains.

Third degree
Involves upper layers of corium.
Scar pinkish-red at first, eventually becomes white and opaque. Is usually supple and of fairly normal texture, but is smooth and glossy owing to absence of hair follicles and sweat pores.
When scar has been formed by coalescence of small foci of epithelium, it may be uneven and assume appearance of small cicatricial bands including smooth islands of protruding scar tissue

Fourth degree
Down to and sometimes including subcutaneous tissue
Invariably uneven and irregular in outline, with processes extending for varying distances into surrounding tissue
Often becomes hypertrophic or keloidal
Contractures frequent.

Fifth and sixth degrees
Charring extends to muscles and even to bone
Require amputation.

I. Epidermis epithelial layers derived from the ectoderm:
  1. Corneum or horny layer—superficial epithelial plates.
  2. Stratum lucidum—absent where the skin is thin.
  3. Stratum granulosum—absent where the skin is thin.
  4. Malpighian or germinal layer—nucleated growing cells.

II. Dermis or corium—connective-tissue elements from the mesoderm.
  1. Papillary layer.
  2. Reticular layer.

The classification of burns in six degrees, after the manner of Dupuytren, is more accurately descriptive than is the American classification in three degrees. Dupuytren's classification is briefly this:

"First degree burns: Involve only superficial layers of the epidermis. No scar remains after this degree, though a slight and transient pigmentation may occur.

"Second degree burns: Involve the whole thickness of the epidermis as far down as the papillary layer of the corium, which layer is left intact. When the blister, which results from this degree of burn, is superficial, and more or less of the epidermis is preserved on its floor, healing takes place readily in a few days to a week, and is so complete that no trace of the injury remains, except perhaps a slight pigmentation, which soon disappears. On the other hand, if the bleb has formed entirely beneath the epidermis and denuded the papillary layer of the corium, or more so if the contents have been allowed to become septic and superficial ulceration has supervened, then an alteration in the texture of the healed skin as a definite scar is inevitable.

"Third degree burns: The epidermis and the superficial layers of the corium are more or less completely destroyed and form the dead piece of burned skin, named the eschar. . . . After the eschar comes away a raw surface is left. . . . Healing then gradually sets in with a new growth of epidermis, in the form of a fine film which spreads in from the edges and from small foci of epidermis which have escaped burning, and appear dotted here and there over the granulating surface and which are either the remains of the basal layer or of pilosebaceous follicles. The islets of epidermis spread and coalesce into irregular patches, which finally join with the new growth from the edges. The scar which results is pinkish-red in color at first and remains so for a considerable time, but eventually becomes whitish and opaque. It is usually supple and of a fairly normal texture, but is smooth and glossy owing to the absence of hair-follicles and sweat-pores. Where the scar has been formed by the coalescence of small foci, it may be uneven on the surface and assume the appearance of a meshwork of small cicatricial bands including smooth islands of protruding scar tissue.

"Fourth degree burns: Not only is the skin involved to its whole depth, but, as a rule, the destruction reaches the subcutaneous tissue. After the eschar separates the raw surface heals slowly, for the new growth of epidermis must take place entirely from the edges, as the epidermal cells of the sloughed area have been completely destroyed. It has been estimated that the new growth occurs at the rate of about $\frac{1}{8}$ inch per week. The scar from burns of the fourth degree is invariably uneven and may be unsightly; it is irregular in outline and not infrequently stellate, with processes extending for varying distances into the surrounding tissue. As a general rule, it may be said that the more rapid the healing, the better the type of scar which will result, and that where healing is delayed for some reason or another, it is liable to be associated with a more or less excessive formation of scar tissue.

"Fifth and sixth degree burns: The charring extends down through the skin and subcutaneous tissue to the muscles and even to the bone. Large burns of this degree are always fatal, but if limited to a hand or foot, recovery may take place with amputation."[1]

Early skin-grafting in the treatment of burns of the third and fourth degrees is of the utmost importance as a preventive of thickened scar, cosmetic deformity and contractures, as well as markedly shortening the convalescence from the commoner fourth and the rarer fifth and sixth degree burns. Granulation tissue is the parent of scar tissue, and, as the rate of epithelial growth from the edges of a wound has been estimated as $\frac{1}{8}$ inch per week, the granulation tissue in the middle of any large fourth degree burn must of necessity be excessive when epithelialization is eventually complete, unless skin-grafting be done. Modifications of Esser's epithelial inlay are applicable to almost all healing burns, even in the presence of some infection. The principle of Esser's method is the use of a dental modeling wax model of the defect to obtain accurate apposition of Thiersch graft to the granulation tissue, and to prevent a destructive gathering of serum under the graft. In the grafting of large areas on a flat surface I have found that by using large meshed paraffined gauze next to the graft, and then applying warm dental modeling wax over the gauze, that slipping of the graft is prevented. The edges of the gauze which extend beyond the grafted area should be firmly strapped down with adhesive. In this way the graft may be safely inspected at any time if the necessity arises, though rarely need it be looked at till the tenth day.

The use of paraffin wax treatment, especially in second and third degree burns, hastens recovery and reduces scar tissue by more rapid epithelialization. In third degree burns epithelialization progresses from the lining of the pilosebaceous follicles, appearing as numbers of small islands, and the paraffin wax dressing is the only dressing which does not damage to some extent these delicate epithelial cells.

Keloid following burn scars results in extreme cosmetic defects. Any injury to the corium may result in keloid, so that it may follow any but first degree burns. There seems to be some stimulus from burns or from the products of tissue disintegration peculiar to burns that favors this variety of new growth, for a far greater proportion of burn cicatrices show this condition than do scars from lacerations. "Keloid is a fibrocellular new growth of the corium, starting in the corium about the vessels, as Warren and others have shown, and consists of dense bundles of fibrous connective tissue running parallel to the surface and usually in the direction of the long axis; here and there, however, they run vertically. The whole cutis is occupied by this new formation, a layer of loose connective tissue, which is more or less highly vascular, separating it from the epidermis, incompletely encapsulating the growth; the tumor itself is not, however, rich in blood-vessels. Nuclei and spindle-shaped nucleated bodies are noted in some abundance along the vessels in the periphery, although scanty in the body of the growth. According to Warren, the vessels are affected far beyond the body of the keloid mass, and this probably explains its recurrence after what would appear to be a complete removal of the tumor. The glandular structures, hair-follicles, and muscular fibers are not found within the growth, but are pushed aside, where they are, according to Crocker, noted to be copiously infiltrated with round cells, obscuring or even breaking up their structure. It is a benign growth, but may from irritation become malignant."[2]

At present *x*-ray and radium therapy seem to offer the best results in combating keloid. At the first sign of hypertrophy of a burn scar radiotherapy should be used, which acts in retarding or removing the growth. I have had excellent results, as have others, by combining excision and radiotherapy. Case II illustrates successful removal of a badly disfiguring keloid of the face, following a burn from an explosion of gasoline. As in this case *x*-ray over the area excised and over the flaps was used both before and after operation, so should it be used in all of these cases, the number of treatments after operation depending on the evidence of return of the growth.

A great variety of treatment has been offered for this condition—pastes, lotions, fibrolysin, injections of creosote, etc., but none of these gives results comparable to those of radiotherapy. Ahlswede has recently recommended the use of pepsin to digest these growths, a solution of this composition—pepsin 10 gm., HCl 1 c.c., phenol 1 c.c., aqua dest. q. s. ad 200 c.c. I have tried this over a period of several weeks on the keloids on the chest in Case II, with apparently some favorable results.

For the surgeon only occasionally attacking the problem of repair of a bad burn scar a few essential rules will prove to be invaluable guides. The first requisite is an accurate estimation of the tissue destroyed. It is most disappointing to the surgeon to prepare a flap carefully, and then, after dissecting out the scar, to discover that the amount of tissue lost and the retraction of the freed tissues far exceeds the size of the flap already prepared. The multiplicity of flap operations evolved by surgeons of the past are disconcerting when studying the best method of attacking a plastic problem. It is better to consider flaps of three types—the sliding flap, the transposed flap, and the pedicled flap. The first is the advancement of tissue nearby into the defect by undercutting and sliding, the second is a transposition of tissue with the base of the flap at the defect, and the third is a bridging over of the tissue from a distance. Blair's suggestion to prepare the flap, lift it from its bed and then suture it back again for several days, is excellent. The blood-supply to the flap is increased, and if all of the flap lives in this position, it is almost certain to do as well in the new location. All large transposed and pedicled flaps should be treated in this manner. They peel off easily and quickly when raised the second time by merely recreating the skin incisions and applying gentle traction. Do not make flaps crossing the midline of the body, especially in the abdominal region. The blood-vessel anastomosis between the vessels of the two sides, in the region of the linea alba, is very limited, and with one patient I experienced the failure of a flap in this location with a prompt necrosis of tissue at the linea alba. Before preparing any flap study the blood-supply carefully. The skin surrounding burn scars of the third and fourth degrees is very often dotted with scars of lesser degree, which are scarcely noticeable until a flap is raised, when their presence will be very evident from the failure of circulation. Also, when burns have been followed by infection, the subcutaneous tissue has often been affected for some distance from the burns, scarring the under surface of the flap and jeopardizing the blood-supply.

Gillies' method of tubing pedicled flaps is invaluable, as thus not only is the blood-supply increased but also the chance of infection is diminished, and tissue from a distance is made available. The tissue may be transported by transposing first one end and then the other, waiting long enough each time for a good blood-supply to be established. Case I was so extensively burned that it was necessary to obtain tissue from the pubic region to replace the contracted scar at the right anterior axillary pillar. The tubed pedicle was transplanted four times to get it to its present position, where it is available for use.

Flaps should be anchored by subcutaneous catgut sutures, so that no strain comes on the skin sutures.

Gillies' suggestion for the after-treatment of flaps has turned many potential failures into success. Warm compresses of normal salt solution with occasional gentle massage will encourage a sluggish circulation or prevent the equally fatal overengorgement of a flap.

Skin-grafts are less effective than flaps in the repair of these scars, but they are indicated for certain conditions. The Thiersch graft and Wolfe graft are of greater value to the plastic surgeon than are the other types. The Thiersch graft, applied after the method of Esser's epithelial inlay, with its numerous modifications, is most reliable. If correctly done, this method of grafting is almost always completely successful. Two points must be kept in mind during the operation—first, to obtain an accurate model of the defect in dental modeling composition, and, second, to maintain a firm, even pressure on the model after it has been wrapped about with a Thiersch graft and applied to the wound. Where the graft is completely buried the tension on the graft is, of course, even, but on flat surfaces special attention must be given to the pressure. Use of this type is indicated to line the under surface of a flap which is to form part of the eyelid, nose, or mouth, or where a flap is needed with epithelium on both sides. Ectropion of the lids, which often follows burns in the region of the eyes, may be most efficiently corrected by Gillies' operation, which is an adaptation of Esser's principle. These buried grafts seem to resist infection better than do grafts on flat surfaces, and they are quite successful within the mouth or nose. Larger grafts of this type often show a tendency to shrink, even though the scar has apparently ceased to contract before repair is done.

Wolfe grafts, or whole thickness, free skin-grafts should only be attempted on a firm base, such as the forehead. They do well with a firm, gentle pressure applied over a dental modeling composition backing. The use of this type is limited and the possibility of failure of the graft, together with the frequent tendency of a successful graft to become pigmented, causes the surgeon to rely mainly on the flap.

CONCLUSIONS

1. Different degrees of burns give different types of scars. An accurate estimation of the amount of tissue lost is essential as the first step in repair of scars.

2. Early skin-grafting of burns tends to a better scar and fewer contractures.

3. Keloid is a new growth and yields best to radiotherapy. Excision with radiotherapy is often indicated.

4. Plastic repair of burn scars is best done by flaps. The surgeon should rely mainly on the basic types of flaps.

5. Skin-grafts are limited in their application, but are valuable about the eyes, nose, and mouth. Esser's method of epithelial inlay has many uses and is very reliable.

The following case histories with photographs are of cases which are not yet finished. However, they illustrate some of the principles of the plastic repair of burn scars.

Case I.—Mrs. M. This is a case of extensive second, third, and fourth degree burns with keloid formation and contracture deformity of both anterior axillary pillars. Patient is white, thirty-four years of age, a dressmaker, and is married. Her past history is essentially negative except for appendicitis in 1919, for which appendectomy was performed. On October 14, 1921 she was burned by a gasoline explosion while cleaning a piece of lace. Burns involved the face, neck, arms, and body, extending to the umbilicus. She was in hospital three and a half months, and burns were treated with boric and saline compresses, also chlorazene compresses and paraffin wax dressings. Part of the areas were skin-grafted. She was referred to me on March 25, 1922. Figure 371 shows her condition at that time and shows the limit of possible abduction of the arms. On March 30, 1922 the larger horizontal keloid on the front of the neck was dissected out and a flap 7 cm. wide was taken from the side of the neck and transposed to the defect. Even this width flap was not sufficient to relieve all the contracture. Though no scarring was apparent on the outer surface of the flap, the under surface proved to be pitted with scars from infection of the wound during time of healing and the distal

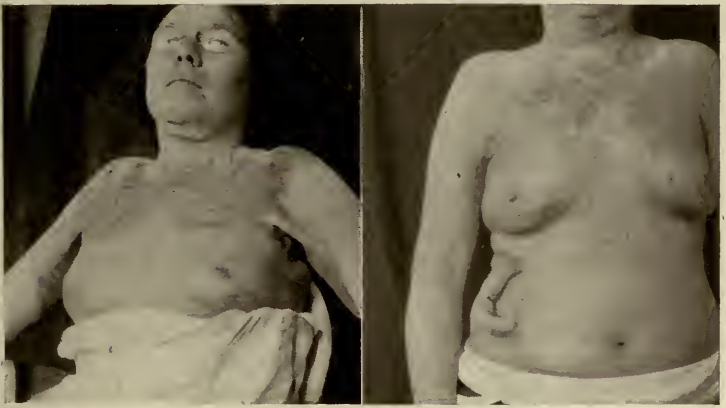


Fig. 371. Fig. 372.

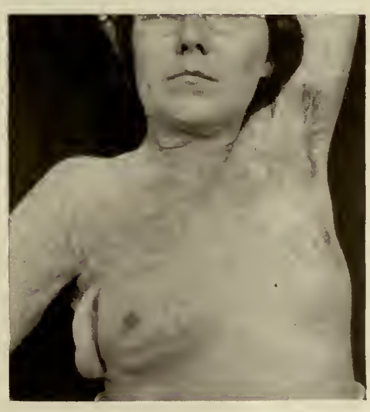


Fig. 373.

Figs. 371–373.—Case I.

fourth of the flap was lost. This step also illustrates the misleading appearance of scars in relation to the amount of actual tissue lost. On April 25, 1922 a tubed pedicle graft was raised on the abdomen in the region of the right lower quadrant, this being the nearest point to the right shoulder that normal tissue sufficient for repair could be found. May 15th the lower end of this flap was transferred upward to the position shown in Fig. 372. September 13, 1922 the scar of the anterior axillary pillar on the left side was excised and a sliding flap, comprised of the tissue of the left side of the chest, was swung upward. The tubed pedicle was also transferred again. Function in the left shoulder, as is present now (March 9, 1923) is shown in Fig. 373. All active motions are practically normal. There is a slight keloidal hypertrophy of the scar of operation, but this is yielding to radiotherapy. Figure 373 also shows the present situation of the tubed pedicle after the fourth transfer, where it is ready to be used for the area of the anterior axillary pillar of the right side, where the scar will be dissected out. This case has had considerable radiotherapy. Pepsin compresses were also tried on the chest, apparently with some success, though no authoritative statement of the value of this treatment could be given without a series of cases with controls. Considerable work remains to be done on this case.

Case II.—Mr. G. illustrates very marked keloid formation. He is white, twenty-one years of age, and there is no history of keloid scars in his family. His past history is negative except for measles and an otitis media from an oat in the ear. At the age of nineteen (March 1, 1921) he was burned in a gasoline explosion and suffered second, third, and fourth degree burns of the face, forehead, neck, and chest, and fifth degree burns of the ears. He was confined to hospital thirty days and during the first two weeks was delirious. He stated that the burns were treated at first with unguentin and later with paraffin wax dressings. No skin-grafting was done and the burns were healed within six weeks. He was referred to me on September 10, 1921, and the keloid growths had then reached the proportion

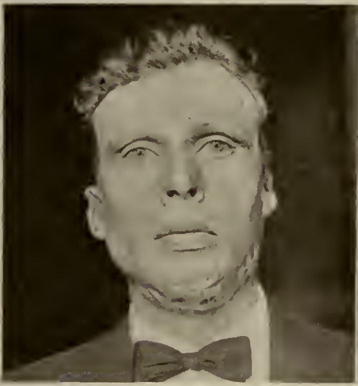


Fig. 374.

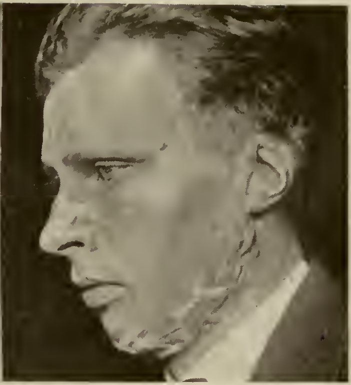


Fig. 375.

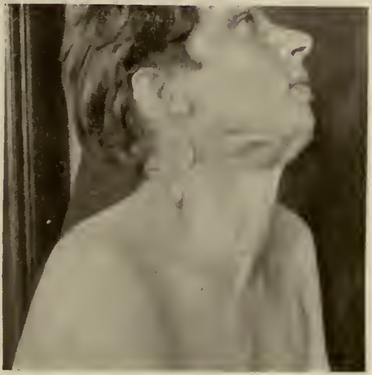


Fig. 376.

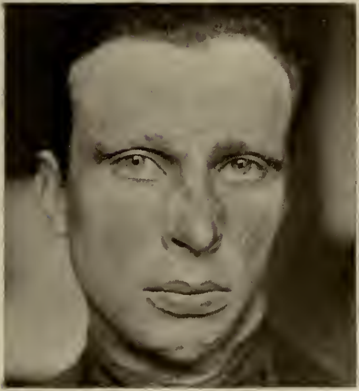


Fig. 377.

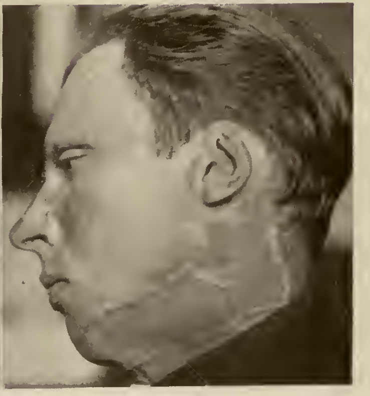


Fig. 378.

Figs. 374–378.—Case II.

shown in the illustrations (Figs. 374–376) in three months from the time they were first noted. The scar of the upper chest and neck had contracted limiting tilting back of the head. He was observed for two months, but no increase in growth was seen, and during this time radiotherapy was used on the scars. The greatest thickness of keloid was confined to the lower face and upper chest and to lesser extent to the forehead and nose. On November 24, 1921 a trial operation was done below the left ear to determine whether keloid would return in the scar. The area was treated with *x*-ray before operation and then scar 2 x 1 cm. was excised, and the defect closed by three sliding flaps. One week after operation *x*-ray therapy was again used over the area. By the middle of January, 1922 no keloid was evident where the scar was removed, and on January 17th a flap 18 x 5 cm. was lifted from the left side of the neck and returned to its bed. No necrosis occurred and on January 28, 1922 the keloid on this side to the symphysis menti was dissected out and the transposed flap used to fill in the defect. *x*-Ray was used on this flap ten days after operation. The raw area in the neck was dressed with paraffin wax dressing. On April 28, 1922 a similar flap was prepared on the other side and the pedicle of the first flap was returned. Nothing is lost by leaving these pedicles attached for a considerable period, indeed, the longer the pedicle remains, the better is the adjustment of the circulation. If the pedicle is returned within two weeks, the flap will usually live, but it passes through a period of imperfect blood-supply, and edema occurs, which lasts longer.

On May 8, 1922 the right side of the facial scar was dissected out and the prepared flap sutured in. July 13th the pedicle was returned. July 31st the tension at the throat was relieved by cutting the scar and allowing the tissues to retract. The raw area was grafted by Esser's method. A complete take resulted, but this eventually contracted. On September 5th a readjusting operation about the chin and neck scars was done. February 20, 1923 a large pedicled flap was prepared on the lower left chest below all scarred areas, and this will be tubed and transplanted twice to replace the keloid and contracted scar at the front of and below the neck. Repair of the ears also remains to be done.

x-Ray treatments have been administered six times since the first operation or in about eight-tenths of an erythema dose.

The results so far are quite gratifying, as there has been little if any recurrence of keloid, and what little has recurred in the scar is disappearing under radiotherapy.

Case III.—Mrs. C. This is a case of a young woman, white, aged twenty-eight, who was burned in May, 1917. Her past history is essentially negative except for attacks of petit mal beginning one year after her marriage in 1915. During one of these attacks she fell forward on a stove and remained there for some time. She suffered second, third, and fourth degree burns of the lips, chin, and neck. She says that the burns were treated with boric compresses and then skin-grafted, and that healing was complete in three months (Figs. 379, 380). Six months later, as the chin had been pulled down by the scar contracture, a flap was transposed from the chest into the scar in the neck. This proved to be insufficient, for a year later the chin was again pulled down. She was referred to me March 15, 1922. At that time the chin could not be raised above the level and scar extended in a straight line from the point of the chin to the chest. Three days later the scar in the neck was dissected out, the old flap freed and allowed to retract normally, and a large flap from the chest was transposed to the defect. The large and small flaps may be seen in Fig. 381. Three weeks after the transference of the flap the pedicle was cut and returned, and the small flap was split to receive the free end of the large one, thus evening the tension (Fig. 382). On April 28, 1922 a small transposed flap from the side of the neck was let into a transverse scar on the left side of the neck. The right corner of the mouth was also reconstructed as it was obliterated by scar. On February 10, 1923 the subcutaneous fat from below the chin was turned up to make a point of the chin, and some tissue below the lower lip was removed to restore the normal curves of the lower lip and chin. This step is not shown. The scars in Fig. 382 seem

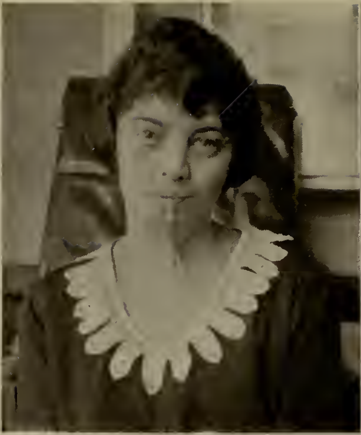


Fig. 379.

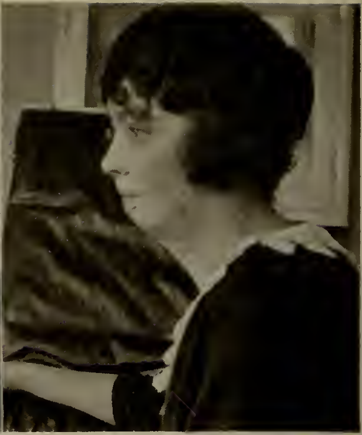


Fig. 380.

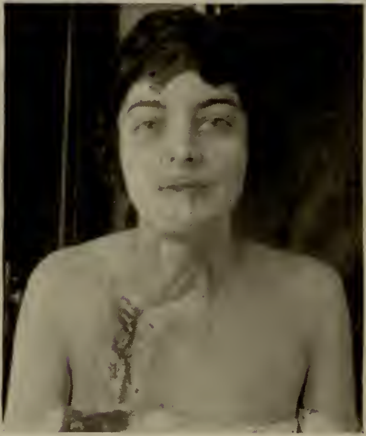


Fig. 381.

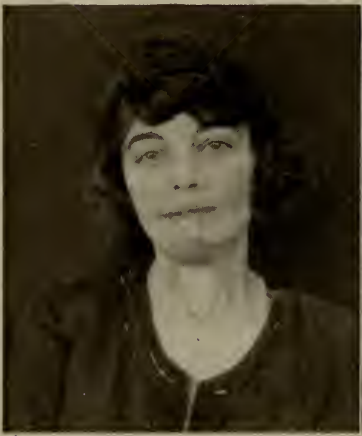


Fig. 382.

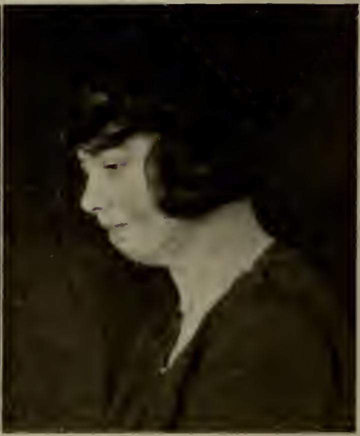


Fig. 383.

Figs. 379–383.—Case III.

prominent, but the picture was taken a short time after operation and they have since faded. Two postoperative *x*-ray treatments were given. The pouting of tissue shown on the side of the neck and at the base of the large flap in Fig. 383 is to be removed.

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CLINIC OF DR. GEORGE K. RHODES

San Francisco Hospital, University of California Surgical Service

COLOSTOMY: A SPECIAL TECHNIC

It is always with disgust and much reluctancy that a patient gives consent to an operation which precludes the possibility of a colostomy. Too often the operation is a disappointment to both patient and surgeon. We are prone to repeat empirically some crude and antiquated procedure hurriedly and thoughtlessly. It would seem, therefore, that more consideration should be given to slight modifications of technic. Such mental endeavor might materially simplify the convalescence and obtain the optimum benefits from the operation.

The intelligent use of the colostomy procedure is meeting with increasing favor. It is a most valuable adjunct to medical therapeutics and an acknowledged preliminary step to radical operations on the lower bowel. A satisfactory method is thus obtained of putting the distal bowel at rest and treating the diseased segment medically or surgically. The coincident pathology of inflammation is soon eliminated from the picture of malignancy, etc., while the patient gains rapidly in weight and general resistance. The patient is accordingly relieved of the original pathology, or at least he has gained a physical status that will better withstand the more radical secondary operation.

In undertaking a colostomy we must keep two important factors in mind:

1. The operation should accomplish that for which it was performed.

2. The patient should be given the maximum control of the opening and the minimum of annoyance.

In order to have the maximum benefits from a colostomy we must completely divert the fecal stream. This can best be accomplished by complete severance of the continuity of the bowel and wide separation of openings.

The question of control of an artificial anus has caused much discussion. The best functioning colostomies are apparently those that are brought out through the rectus muscle and fascia. The presence of a dependent loop of colon such as is possible when the redundant sigmoid or transverse colon is used is a real asset to better function. This dependent reservoir acts like the ampulla of the rectum and accumulates considerable feces before emptying. The extraperitoneal subcutaneous tunnel of gut gives an additional factor which improves function and control.

The ultimate success of the colostomy performed depends upon proper regulation of the bowels after operation. A normal rhythm of evacuation and the prevention of liquid stools are fundamentally essential. The bowels should be encouraged to move at a regular time each day by suitable dieting and avoiding aperients. In most cases a very satisfactory control and regulation can be obtained in a few months' trial. If control is not satisfactory an enema each morning will serve to regulate the movements.

An abstract of the case history of one of these patients will be given and a method of treatment outlined.

Case History.—Mrs. E. C., aged twenty-nine. Case No. 59,860. San Francisco Hospital.

Complaint.—Mulpitle perineal fistulæ, rectal incontinency, rectal stricture, increasing constipation, loss of weight.

Past History.—Irrelevant. History of questionable Neisser infection and proctotitis (neisserian?) three years ago. No history or evidence of lues or tuberculosis. Wassermann negative.

Present Illness.—Began two years ago with pain in rectum and passage of blood. Since then patient has had multiple perirectal abscesses incised, and each has persisted as a discharging fistula. Six months ago an annoying rectovaginal fistula developed. In spite of multiple rectal operations the fistulæ persist and patient has no sphincter control. Bowel movements only with enema. Small ribbon-like stools. Loss of weight.

Physical Examination.—Quite negative except for rectal condition. Note on rectal and proctoscopic examination: There are multiple perirectal fistulæ present. Sphincter has been cut twice and largely replaced by scar tissue. Two cm. from anal-cutaneous margin is a stricture that will not admit the tip of little finger. This stricture was with difficulty dilated sufficiently large to admit a small proctoscope, which disclosed a second stricture about 9 cm. from the first. Between these two strictures is an area of marked ulceration into which most of the fistulæ open. Vaginal examination disclosed a recto-vaginal fistula opening into posterior fornix.

Recommendation.—Some form of a colostomy operation that will completely divert the fecal current and afford an opportunity to irrigate the distal segment. The nature and extent of the pathology present practically necessitates that the colostomy be permanent.

Operation.—The technic as outlined in this case is my resultant effort of repeated attempts to overcome practical difficulties in the operation for colostomy.

Step 1.—Left rectus incision 3 inches long is made through the outer third of rectus muscle just below umbilicus (Fig. 384).

Step 2.—Peritoneum opened and general exploration done to determine the nature and extent of the pathology present and the practicability of further radical procedures, resection, etc.

Step 3.—Loop of most mobile sigmoid withdrawn from wound and held by assistant. First layer of sutures now placed, which closes the peritoneum and stitches the parietal and visceral peritoneum together where the constricted loop of sigmoid comes through the incision (Fig. 385, *a*).

Step 4.—Rectus muscle and anterior rectus sheath closed with chromic gut snugly about the constricted loop of sigmoid. In suturing the proximal loop to anterior sheath an attempt is made to "telescope" the bowel (Fig. 385, *a*). (This theoretically forms a valve-like action in addition to the muscle constriction.)

Step 5.—Sever the bowel between two Payr's clamps with cautery. (Long proximal and short distal loops) (Fig. 385, *a*).

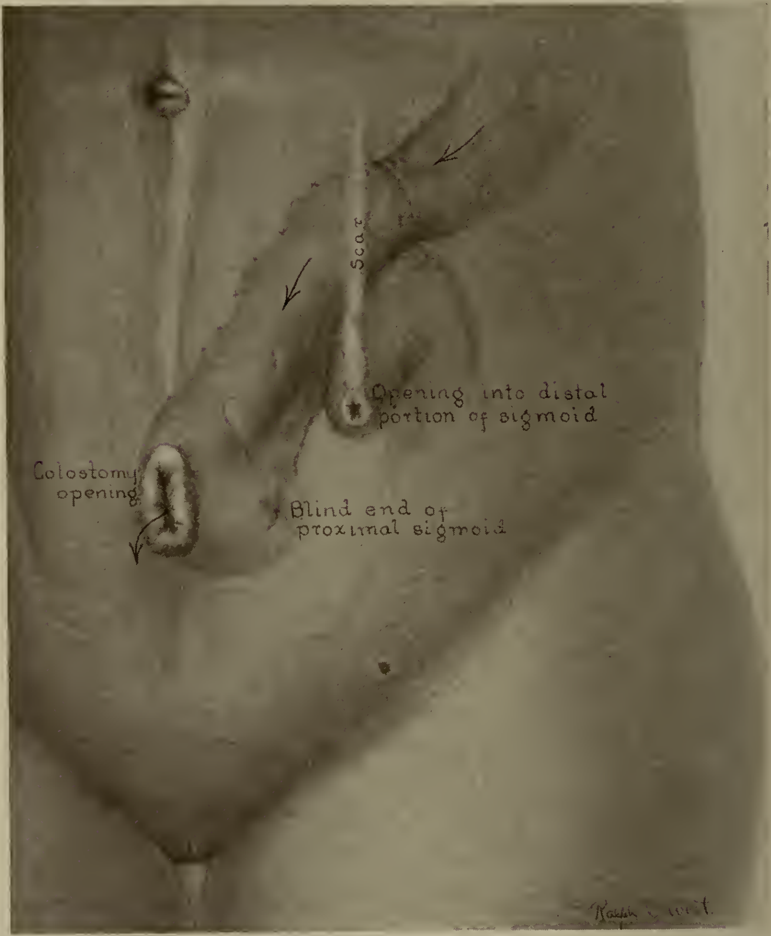
Scar
Opening into distal portion of sigmoid
Colostomy opening
Blind end of proximal sigmoid

Fig. 384.—Wide separation of openings. Proximal opening near the inverted end avoids traction on mesentery. Distal loop has small orifice.

Invert both ends with usual inverting basting stitch (Fig. 385, *b*).

Step 6.—Dissect the median flap of the incision from anterior rectus sheath. The proximal loop is now stitched to the anterior rectus sheath and its distal end brought out through a stab-wound above pubes (Fig. 386).

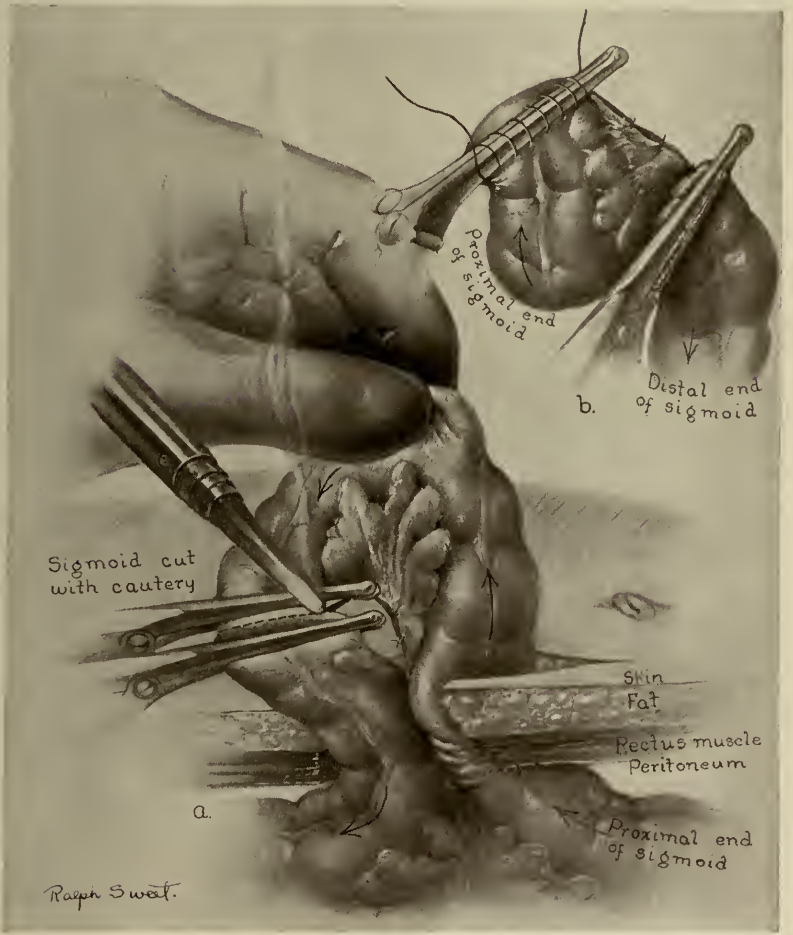

Fig. 385.—*a*, Division of continuity of the colon and its mesentery. (Peritoneum has been previously closed.) *b*, Aseptic technic of inverting severed ends.

(Note: Great care must be exercised to avoid impairing circulation to divided segments. A slit parallel to the vessels will often materially aid in mobilizing the mesentery. The site of future colostomy is made about 2 cm. from inverted end to avoid hazardous torsion and traction on the mesenteric vessels (Figs. 384–386).)

Step 7.—The distal inverted loop is brought up to lower end of original incision, which is now closed completely. The inverted segment is buried, but its location marked by a single linen suture, which protrudes from wound (Fig. 385).

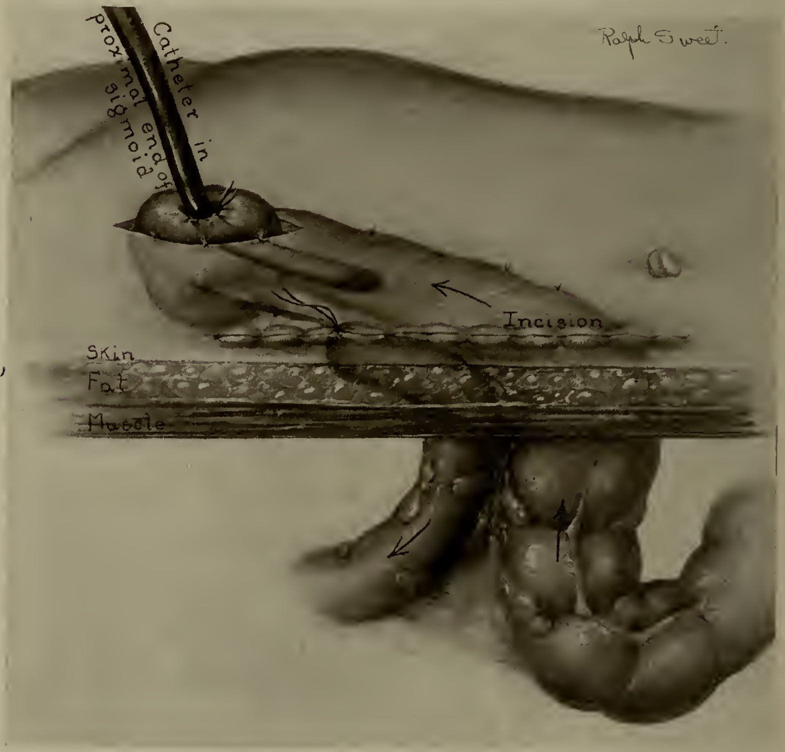

Fig. 386.—Condition immediately postoperative. (Blind distal segment buried and catheter fastened into proximal loop.)

Step 8.—A rubber catheter is inserted into portion of proximal loop protruding from the stab-wound and secured by inverting purse-string sutures. (The catheter will drain the gas and fluid content of the proximal loop for twelve days, when colostomy opening may be established without fear of infecting abdominal wall (Figs. 385, 386).

Postoperative Course.—(*a*) Wounds should heal *per primam.* (*b*) The patient will be given non-residue diet and mineral oil for the first ten days. Give regular diet when the catheter is removed and colostomy opened (see text for diet, postoperative care, etc.). (*c*) After the twelfth day the distal loop may be

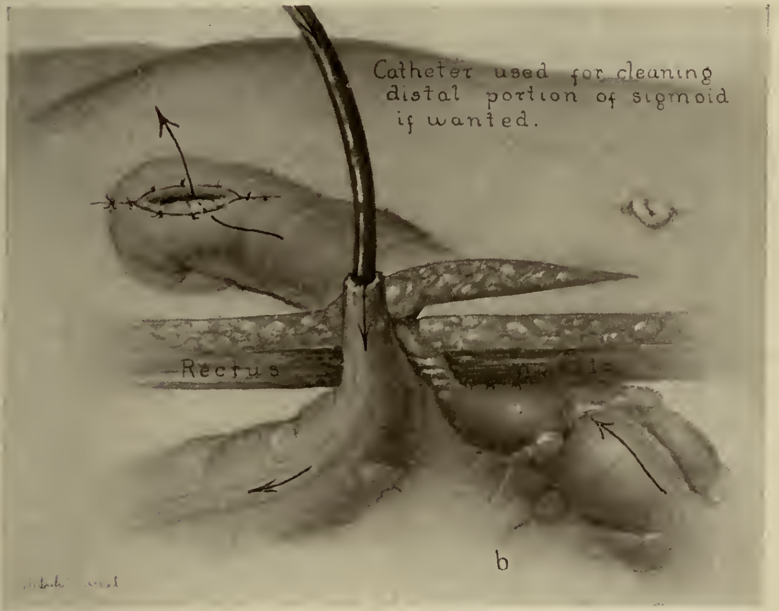
Catheter used for cleaning distal portion of sigmoid if wanted.
Rectus
b

Fig. 387.—Lateral view. (Plastic mucocutaneous opening made for proximal loop. Small opening in distal loop for irrigations, etc.)

located and the opening made sufficiently large to admit catheter for irrigating the diseased lower segment. (Danger of infecting original incision is now past.) (Fig. 385.)

At this time excess of mucosa from proximal loop may be removed and a plastic mucocutaneous union established (Fig. 387).

Postoperative Note (Three Months After Operation).—Patient has gained 35 pounds in weight and is very pleased with the colostomy, which rapidly restored her general health and cured the annoying multiple perineal fistulæ. The patient has one bowel movement in the morning and the balance of the time wears only a small piece of gauze over the openings. (She has discarded her colostomy bag entirely.) Examination shows the process of perirectal healing and cicatrization has resulted in complete closure of the multiple fistulæ, and the rectal canal itself will hardly admit a small probe. The colostomy is not a source of embarrassment to this young woman, but, on the contrary, it has enabled the patient to resume her work and lead an active social life again.

Comment.—The operation as outlined has proved to be a practical aid in relieving the shortcomings of the usual colostomy procedures. The simple technic involved is flexible and can be varied to meet the individual case. Some of the apparent possibilities of such a technic are: (1) Careful exploratory laparotomy. (2) A good functioning temporary or permanent colostomy. (3) Complete diversion of fecal current. (4) Wide separation of openings, and hence no annoying fecal accumulation in distal segment. (5) Opportunity to irrigate distal segment satisfactorily. (6) Avoids retraction or prolapsus of mucous membrane. (7) Opportunity for secondary operation: (*a*) Ability to reunite the continuity of the bowel by extraperitoneal methods. (*b*) Distal segment may be removed in whole or part.

The University of California Service at San Francisco Hospital has offered ample opportunity to establish this operation as the technic of choice in suitable cases.

I am indebted to Dr. Harold Brunn for the opportunity of carrying out this work on his service at the San Francisco Hospital.

CLINIC OF DR. ALICE F. MAXWELL

UNIVERSITY OF CALIFORNIA HOSPITAL

PELVIC INFLAMMATORY DISEASE

HERE are three women who come to the clinic complaining of lower abdominal pain and profuse menstrual discharge.

Case I.—The first, Mrs. W., aged thirty-nine, widow for twelve years.

Family history negative. Past history, ordinary childhood illnesses. No serious sickness or operations.

Catamenia began at thirteen, twenty-eight-day type, at times irregular, normal in amount, no pain.

Married at seventeen. Three children, living and well, aged nineteen, thirteen, and twelve. No miscarriages. No vaginal discharge.

Patient gives no history of any cardiac, respiratory, intestinal, or urinary pathology.

Present Illness.—Patient was perfectly well until January 29, 1923, when she was seized with a lower abdominal pain. This pain was at first a dull ache, but with the onset of the menstrual period one day later the pain became generalized over the entire abdomen and very severe. There was no nausea or vomiting until four days after the onset of the pain in the abdomen. Then the vomiting became constant and consisted of dark stained fluid. This vomiting and severe pain continued for seven days without relief by opiates. The patient's bowels had moved once during the present illness, following a large dose of castor oil taken the first day. The patient was brought into the hospital on February 5th, one week after the initial pain. She presented the typical Hippocratic facies—dry skin, sunken eyes, weak, thready pulse.

Physical examination negative save for marked tenderness over the entire abdomen, but most marked in the lower half, where the walls are held rigidly and board-like. On vaginal examination the mucosa was hyperemic in appearance; the urethra was without evidence of inflammation. A thick yellowish discharge, slightly blood-tinged, was exuding from a lacerated cervix. The uterus was of normal size, the slightest movement causing extreme pain. The broad ligaments were filled with tender fixed masses. Vaginal examination was extremely painful. The entrance temperature was 36.4° F., which rose to 38° F. within twelve hours (17,000 white blood-cells, 75 per cent. hemoglobin, to 19,000 with 92 per cent. polynuclears). Urine dark amber, few pus-cells, slight trace of albumin.

Discussion.—Here we had a woman acutely ill, presenting symptoms of an intra-abdominal crisis of one week's duration. The dry skin, sunken eyes, pallor (peritonitic facies), the continuous vomiting, abdominal pain, rigidity, and rapid thready pulse were text-book symptoms of a peritonitis. The fever and leukocytosis were confirmatory evidence.

The patient's history was not of significance except for the fact that the onset of the attack was definitely related to the menstrual cycle. Of course, it must be borne in mind that the occurrence of an abdominal crisis, *i. e.*, acute appendicitis, cholecystitis, rupture of a peptic ulcer, etc., may be coincident with the catamenia, yet such pathology may have no causal relationship. On the other hand, the symptoms of a recent pelvic infection or a chronic pelvic peritonitis are very frequently exaggerated by the pelvic circulatory alteration associated with menstruation. The rigidity, distention, abdominal pain, vomiting, and constipation are characteristic only of a peritonitis.

The significant findings, however, are, first, the greater rigidity or increased pain in the lower abdomen, equally marked in both lower quadrants; a perforated appendix or ulcer would be followed by peritonitis which would by gravity tend to localize in the lower abdomen. However, we would expect unilateral involvement or evidence of more marked infection on one side of the hypogastrium. Important also was the fact that the symptoms had existed for a week before entrance practically unchanged. With perforation of a hollow viscus, after an interval of a week, we would expect to find either a walled-off abscess, especially if the appendix were the etiologic factor, or a generalized and progressively spreading peritonitis. Another significant finding was the evidence of inflammatory reaction in the pelvis, involving both broad ligaments with sausage-shaped tender masses on either side of the uterus. Despite the absence of any history of an old or recent pelvic infection, the onset of lower abdominal pain incident to menstruation was highly significant.

A cervical smear was taken which showed a field filled with leukocytes and Gram-negative intracellular diplococci. This, of course, was highly confirmatory evidence of a pelvic infection. However, a negative smear does not rule out a neisserian infection, for it is not always possible to demonstrate the gonococcus, especially in chronic cases. In this woman there was no evident infection of Bartholin's glands or Skene's glands at the urethral orifice, a frequent nidus for the organism. Following a menstrual period the diplococcus may be obtained from the cervix, whereas frequent examinations between the cycle may be entirely without result. Briefly, then, this woman presents a picture of an acute peritonitis, localized to the pelvis and lower abdomen, with evidence of bilateral salpingitis, and the gonococcus as the probable infecting agent.

The treatment should be conservative. All attempts at therapy should be aimed to limit the infection to the pelvis and lower abdomen, to control the vomiting and pain, and to administer food.

The patient was placed in the Fowler position, and this position was maintained for a considerable period. Glucose and sodium bicarbonate were given by Murphy drip. To relieve the vomiting lavage was done and repeated when indicated by return of symptoms. Large amounts of salt solution were given subcutaneously (2000–4000 c.c.). An ice-bag to the lower abdomen and morphin sulphate controlled the pain. Twenty-four hours later the patient was distinctly improved and the vomiting ceased. The woman continued, however, to run a fever ranging from 38° to 40° C. for a week, when the temperature slowly subsided. Five days after entrance an indefinite mass appeared on the left side, reaching as high as the umbilicus. With the onset of an acute diarrhea the tumor gradually disappeared simultaneously with a great amelioration of the lower abdominal pain. This deserves a word of comment. Occasionally a collection of pus originating from a pelvic infection may be walled off by the bowel and finally perforate the structure. Such a complication may be followed by serious consequences and spread of the peritonitis, or the evacuation of the pus pocket may be the beginning of the healing process.

Four weeks after her illness began her temperature became normal and the leukocytes dropped to 14,500. Her temperature has been normal now for two weeks and the leukocytes are 8000. It is six weeks since the patient became ill. She is the main support of her children and is most anxious to resume her duties.

The patient is brought down for operation today because we feel that, after six weeks, her pelvic infection is well walled off and the pelvic organs can be explored without much danger of spreading the infection into the general peritoneal cavity. With the onset of menstruation her symptoms may become acute, which will prolong her hospitalization.

The patient is anesthetized with gas and oxygen and the vagina carefully cleaned with lysol ($\frac{1}{2}$ per cent.), sterile water, soap, and alcohol. The bladder is emptied by catheterization, followed by an instillation of 10 c.c. of Agno 3 1 : 200. Under anesthesia the uterus is felt to be slightly enlarged and fixed. Masses the size of an orange distend both broad ligaments.

The abdomen, after being scrubbed with alcohol, ether, and iodin, is opened in the midline by an incision from the umbilicus to the pubic hairline. We feel that a long incision offers the advantages of an easy exposure of the pelvis which increases the speed and facility of the surgical procedures. On cutting through the skin, muscles, and fascia we are impressed with the amount of bleeding from these structures. We have noticed that this congestion is always present with an inflammation in the lower abdomen. We are careful in incising the peritoneum, for it is possible we may find loops of small bowel adherent to the parietal peritoneum, a pretty example of nature's method of limiting the spread of infection. On opening the peritoneum we see the omentum plastered to the anterior abdominal wall, to the bladder, and completely covering over the pelvis. By gentle dissection this omentum is freed. Releasing the bladder, which feels thickened, a pus-pocket is opened up immediately below the symphysis. The pus is quickly sponged away, although we are not unduly concerned with the danger from this material, for the patient has undoubtedly developed a considerable immunity to this infection. As the omentum is freed from the bladder the fundus of the uterus is exposed. Notice the congested appearance and the adhesions of several loops of the small bowel to its posterior surface. It is of interest that the uterus is in anterior position. It is rather more frequently found retroposed, being drawn backward by the adhesions forming between the posterior layer of the broad ligament as a result of the spread of infection from the fimbria of the tubes. The fundus of the uterus is grasped and drawn upward by clamps. The loops of small bowel are released from the pelvis and now the general peritoneal cavity is protected by packing off the bowel by a large rubber-dam. Both tubes are buried in the pelvis and the ovaries are covered over by the swollen tubes. The adnexa are shelled out of the culdesac, which causes considerable oozing from the raw peritoneal surfaces. Note the sausage-shaped masses, which are the tubes. The fimbria are completely obliterated. The tubes feel hard and indurated and are distended by purulent material. As the ovaries are delivered we note that they are enlarged and boggy, with reddened adhesions over their surface.

We feel that the best interests of this patient will be met by cleaning out her pelvis and removing the damaged organs. The ovaries are so hopelessly involved in the infection that their retention may be a liability to the woman. We are removing the uterus and cervix which we know harbors the infection, and which, if allowed to remain, will keep up a chronic discharge.

Both tubes and ovaries are removed with the uterus. Following the closure of the vaginal canal we suture the round ligaments to this structure for support of the vaginal vault. There has been considerable oozing from the culdesac and the shaggy raw surfaces left on the posterior layer of the broad ligament. We pack the culdesac firmly with warm gauze; after a few moments the oozing is controlled. Now we cover over the raw surfaces in the pelvis by suturing the free edge of the sigmoid colon to the peritoneum of the bladder with a fine catgut suture. As you see, this walls off the pelvis and prevents the small bowel from dropping into the culdesac and becoming adherent. The raw surfaces on the bowel are inverted with a continuous No. 00 catgut suture, and we repair the damages to the omentum with the same material. When the abdominal wall has been closed and when the patient is still under the anesthetic we shall allow 2500 c.c. of tap-water to run into the bowel through a funnel and large rectal tube. As soon as the patient is placed in bed and before she wakens, a hypodermic of heroin or morphin will be given and another liter or liter and a half of water will again be given by bowel. This fluid is retained in the large majority of cases and does away with the postoperative thirst and adds to the comfort of the woman during the first twenty-four hours postoperative.

The next patient is a young woman who enters the hospital complaining of pain in the lower abdomen and vaginal bleeding for ten days.

Case II.—Miss Y., aged twenty-five.

Family history and past history not significant.

Catamenia began at fifteen, normal in every respect. Patient is single. Three months ago she was delivered in the obstetrical department of a full-term pregnancy. The prenatal period was normal except for burning urination and a purulent vaginal discharge, both of which appeared in the last five months of the pregnancy. A smear was not taken. The labor was short and normal. Twenty-four hours after delivery her temperature rose to 38° C., but promptly dropped and remained flat except for a temporary rise to 37.5° C. on the fourth and seventh day postpartum.

Present Illness.—Three months following delivery the patient was seized with a sharp pain in the left lower quadrant of the abdomen, the pain gradually spreading to the right side. There was no nausea or vomiting. After a few days there was a constant dull ache above the symphysis. Two weeks later the patient began to menstruate, during which time the pain again became severe. The flow lasted for four days. After an intermission of ten days the bleeding commenced and the girl has been hemorrhaging continuously for ten days.

The physical examination reveals nothing except tenderness over the lower abdomen. Pelvic examination shows considerable bloody discharge from a soft hyperemic cervix. The uterus is in anterior position, normal size, and softened. Both ovaries feel enlarged and the broad ligaments are infiltrated and tender. However, there are no palpable masses. The temperature at entrance is 36.8° C. Leukocytes are normal. Urinalysis negative.

Discussion.—This young woman, unmarried, has been recently pregnant. A significant finding is the history of dysuria, frequency, and a purulent vaginitis coming on during the pregnancy. These symptoms, of course, are strongly suggestive of a pelvic infection; it is unfortunate that no urethral or cervical smears were taken at this time, a most favorable opportunity for demonstrating the gonococcus. If we grant that the patient became infected during her pregnancy, it is of interest to note that her puerperium did not show a more febrile reaction, for at the end of labor the decidua and raw placental site offers a most suitable field for the growth of micro-organisms. It is well established that a gonococcus invasion of the genital tract rarely attacks the lining of the uterus. When the endometrium becomes converted into decidua, however, this relative immunity is lost, and during the puerperal state a true decidual endometritis due to the gonococcus may develop. Such a uterine infection from a chronic or recent neisserian infection of the cervix is a frequent cause of puerperal morbidity. This pre-existing infection is frequently unrecognized, and the conscientious obstetrician is often greatly chagrined (after having exercised every precaution to prevent exogenous infection during labor) when an acute endometritis develops. The prevalence of this type of pelvic infection in woman is a vital factor in preventing marked and continuous reduction of maternal morbidity and not a lack of appreciation by the obstetricians of the advances made in recent years in surgical technic and asepsis.

The elevations of temperature in this girl's puerperium, although transient, may well be attributed to a decidual involvement. Three months after the birth of her child menstruation appeared, and again we notice the onset of acute lower abdominal pain just antedating the phenomenon. The patient had not had dysmenorrhea previously, so that this finding now is very suggestive.

A persistent vaginal hemorrhage coming on after a labor must always bring up several possibilities. First, we always think of retained placental tissue which causes bleeding immediately after delivery or within the early weeks of the puerperium. It would not be unusual for a hemorrhage to occur three months following labor from retained fetal elements.

A subinvoluted uterus may cause persistent bleeding, yet in this condition the uterus is soft, boggy, and considerably enlarged, and is commonly found retroposed and low in the pelvis. However, the uterus of this patient is softened but not enlarged and is well anterior. A chorio-epithelioma must always be borne in mind, especially after a pregnancy, but the hemorrhage with such a neoplasm is very profuse without remissions. We feel, then, that the patient illustrates a clear-cut example of a pelvic peritonitis following childbirth due to an endogenous infection, with the gonococcus as the etiologic factor, although we cannot demonstrate the organism at the present time. The history of purulent vaginal discharge and frequent burning urination during pregnancy, the low-grade fever following delivery, and the presence of tender bilateral masses in both broad ligaments make the diagnosis.

Treatment.—This girl has been in bed for ten days, and has been receiving ergotin and stypticin by mouth. She has continued to bleed steadily and has constant lower abdominal pain. The question of operative interference must now be considered. We are prepared to do a laparotomy today. After the usual vaginal cleansing we dilate the cervix. The cervix is very soft and is stretched without difficulty. This ready dilatation of the canal is apparent, when we can see how easily the dilators are passed through the internal os. The congestion of the pelvis as a result of an inflammatory reaction will explain the bleeding and softening which we find. The endometrium which we move is normal in appearance and amount, a finding which rules out a chorio-epithelioma from consideration as a cause of bleeding. We shall examine the endometrium microscopically, but will not expect to find an inflammatory infiltration of the tissue. Rather the picture will be that of a glandular hypertrophy and dilatation with dilated blood-vessels and possibly a slight round-cell infiltration.

The abdomen is opened now by a long midline incision and the bowel packed off by a rubber-dam. Note the hyperemic mottled appearance of the uterus, the omentum adherent to the fundus and broad ligaments, and the engorged vessels in the bladder peritoneum. With gentle dissection these omental adhesions are released and the pelvis is exposed. The tubes and ovaries are adherent posteriorly in the culdesac; we shell them out from their bed and find that both tubes are sealed off and the fimbria obliterated. The tubes are swollen, indurated, and congested. The ovaries are enlarged, especially the left. Note the numerous bluish cystic structures shining through the cortex and the shaggy reddened adhesions on the capsule. Some investigators consider the excessive hemorrhage found so frequently with pelvic inflammatory disease as an expression of an excessive cyst formation in the ovary from a disturbance of circulation.

Treatment.—The treatment of this girl's pathology opens up a field of wide discussion, namely, the relative value of radical and conservative surgery in the treatment of pelvic inflammatory disease. There is no doubt that both tubes are extensively and permanently damaged so that they are unable to function as reproductive structures; so from that standpoint they deserve no consideration. To eradicate the infection in the pelvis we shall do a bilateral salpingectomy. The importance of maintaining the utero-ovarian harmony and relationship must come up for consideration. If we can permit this girl to keep an ovary without undue risk of subsequent pain or secondary operation from the retained gland, we know that the endocrine balance of the patient will be maintained and psychic and vasomotor disturbances which follow loss of ovarian tissue will be prevented. The right ovary, although showing inflammatory changes, *i. e.*, enlarged and covered with adhesions, is more normal than its fellow; it shall be retained for its endocrine and menstrual function. We shall tell this patient that she may have some temporary discomfort or pain on the right side; there is a remote possibility also that this tissue may be so pathologic that the normal function of the gland cannot be maintained. In the right mesosalpinx ligament the individual blood-vessels supplying the tube are separately ligated close to the tube. We are trying by this method to disturb as little as possible the circulation in the mesosalpinx, for the integrity of the retained ovary depends upon the maintenance of an adequate circulation. The cut surface of the mesosalpinx and the raw areas on the posterior surface of the uterus are covered over by the Webster method of suspension.

Case III.—The next patient, a woman of twenty-nine, married, comes into the clinic complaining of lower abdominal pain of one month's duration.

The past history is not important except that at the age of nineteen, following a normal full-term labor, she was confined to bed for five months with a "high fever." Menstrual periods have always been regular and normal, but since her labor she has had dysmenorrhea. No other pregnancies. No leukorrhea.

Present Illness.—Three weeks before entry the patient had pain in the lower abdomen, with nausea, but no vomiting. (She had had an appendectomy at the age of twenty-four.) With the onset of the menstrual period the pain became aggravated. The period was not abnormal except for the severe pain which has persisted. The patient had had similar attacks since the birth of her child, although not as severe as the present illness.

Physical examination was negative except for the marked tenderness and rigidity of the lower abdomen and the presence of a fluctuant mass obliterating the culdesac. The entrance temperature was 39° C. The leukocytes were 23,000, with 76 per cent. polymorphonuclear cells. A cervical smear showed numerous streptococci in short and long chains. The uterus was retroposed and fixed. Both broad ligaments were infiltrated.

Discussion.—This woman gives a history of a high fever coming on after labor, and an illness which confined her to bed for five months. In postpartal disease the streptococcus plays the most important rôle, although the colon bacillus, gonococcus, staphylococcus, and staphrophyte play a considerable part. The course of a pelvic infection depends upon the nature and virulence of the infection, the resistance of the woman, and the condition of the genital tract. An infection is more serious during the puerperal, pregnant, or menstrual cylces than in the resting condition. During pregnancy, or the puerperal state, the anatomic changes in the blood- and lymph-vessels offer a most favorable field for the development of bacteria and the absorption of their toxic products. Lymphangitis, phlebitis, and septicemia are frequent at this period due to the alteration of the pelvic circulation. This patient presents now with a pelvic abscess. We have, however, already mentioned that the commonest infection of the pelvic organs and the most frequent cause of suppurative inflammation is an invasion by the gonococcus which causes a bilateral salpingitis and leads to closure of the tubal ostia by involving the mucosa. Tubal infection due to the streptococcus, staphylococcus, and the colon bacillus is often unilateral and results from a spread of the inflammation through the lymph-stream from diseased and neighboring parts, *i. e.*, metritis, cellulitis, peritonitis. In contrast to the gonococcus, the former organisms attack the serous coat (perisalpingitis) and by adhesions and angulation may close off the abdominal ostium. However, they rarely cause a pyosalpinx and more uncommonly a pelvic abscess years after the initial infection.

Treatment.—The day following her admission a posterior colpotomy was done and the abscess fully drained and packed with gauze. A culture from the pus was sterile. The temperature dropped to normal for one week, with a subsequent rise after that period. The colpotomy was again opened and considerable drainage followed, with alleviation of the symptoms. Two weeks later the patient was discharged with a normal temperature and leukocyte count and with a tender mass on the right broad ligament. In the last month this woman has entered the hospital twice on account of recrudescence of pelvic pain and fever, once incident with the catamenia. The induration in the culdesac meanwhile has steadily diminished in size, while the mass in the right side has become larger. Three intramuscular injections of sterile milk (10 c.c.) have been followed by no constitutional reaction or apparent alteration of the inflammatory infiltration. The temperature and leukocytes have been normal for ten days.

After six weeks of conservative treatment without improvement we shall inspect the pelvic pathology this morning. The vagina has been thoroughly cleaned by the method already described. The abdominal wall is opened by a midline incision. We expose the pelvis by packing off the bowel with rubber-dams. Now we see the typical picture of a pelvic infection with the crippling residuum of the involvement manifested by adhesions between a retroposed uterus, small bowel and adnexa, and a left tubo-ovarian abscess fixed in the culdesac. It was this abscess which was drained by the previous colpotomies. The right tubo-ovarian mass, however, is adherent to the anterior surface of the broad ligament immediately on top of the bladder. Because of the rather unusual position of this abscess drainage by a vaginal incision could never be effective. We feel that the lesions are so extensive in this patient and her suffering has been so constant that a complete removal of the pelvic structures is indicated. We shall do a panhysterectomy and bilateral salpingo-oöphorectomy as offering the best chance of a complete cure and affording a satisfactory method of thoroughly peritonealizing raw areas in the pelvis.

CLINIC OF DR. H. H. SEARLS

University of California Hospital

POSTOPERATIVE VENTRAL HERNIA

An examination of the literature reveals Gerdy's report of the surgical repair of a large ventral hernia in 1836 as the first record of such a procedure. Hampered by the poorly developed technic of his day he nevertheless ingeniously devised a method which gave relief. He inverted the entire sac, including the skin, and sutured the edges of the ring together. He then poured ammonia into the inverted sac, causing a chemical denudation and resultant adhesions. He states that he obtained firm union in seven or eight days.

Other procedures were tried, with varying success. There could be little hope for surgical cure of any type of hernia until a technic permitting primary union of wounds had been perfected, for infection is, even with modern asepsis, the commonest cause of recurrence.

Maydl in 1886 first used a technic approaching present-day methods. He dissected out the various layers and repaired them separately.

Following his work the next few years saw surgeons emphasizing the importance of the muscular layers of the abdominal wall and various muscle plastic operations were devised.

In 1890 Sänger made the first attempt at a purely fascia-plastic operation for ventral hernia.

In 1899 W. J. Mayo brought forward the principle of an overlapping fascia-plastic from above downward. This idea steadily gained favor and is probably the most popular method today. It was primarily designed for umbilical hernia, yet the principle may often be applied to postoperative ventral hernia.

Judd in 1912, following out this same idea, suggested utilizing the entire abdominal wall except the skin and subcutaneous tissue as a single flap, applying the peritoneum of the upper flap to the anterior surface of the fascia of the lower flap. He found that this method gave as good a result and shortened the operation materially.

With this brief history of the development of the surgical treatment of the condition we will now proceed to the discussion of the problem as we find it today. The ideas presented here are, in general, those of the members of the surgical department of the University of California Medical School. A study of 10 cases operated on by the writer will serve to illustrate various points in the discussion.

Etiologic factors are of importance. They must be well understood in order that we may prevent the development of hernia in our laparotomy wounds. Infection of the wound, with sloughing of fascial layers, is the most common cause of the later development of hernia. Mikulicz emphasized this point. We believe, however, that careful treatment of such infected wounds may often result in a strong wall and prevent this sequel. Six cases in our series had infected wounds with prolonged drainage following the first operation.

The type of incision is important. A long incision may cause a hernia through the cutting of nerve supply and resultant atrophy of muscle. It is to avoid the long wound that Mayo advises a separate incision for removal of the appendix if it is found diseased when an operation on the stomach or gall-bladder is being done through an upper abdominal incision.

The type of closure bears directly on the problem. Following Dr. W. I. Terry's lead the members of our staff lay great emphasis on the careful closure of laparotomy wounds. A running suture, which will leave no pockets or holes, closes the peritoneum and transversalis fascia, or posterior sheath of the rectus. Closure of the muscle layer is not considered important, and only a few interrupted approximating stitches, if any, are used. The fascia (aponeurosis of the external oblique, or anterior sheath of the rectus) is the strongest layer of all. The mere approximation of the cut edges of this thin fibrous sheet would not permit of a strong union. Accordingly, after carefully cleaning off the subcutaneous fat, one edge is overlapped on the other for a distance of $\frac{1}{2}$ cm. or more by means of interrupted mattress-sutures of catgut, and the free edge tacked down with a second row of sutures. This gives a broad, firm union. This procedure is routine and we consider it the most important step of the repair.

Transection of muscle fibers is avoided, as this is felt to be a factor in the development of hernia.

Drains left in the wound over a long period may cause the formation of hernia.

The site of the wound has a bearing on the incidence of hernia. Rarely do we find postoperative hernia in the upper abdomen, the weight of the viscera resting more heavily on the lower abdominal wall. All of the wounds in our series were below the level of the umbilicus.

Postoperative vomiting, coughing, or distention may cause a hernia to develop before the wound is healed. A rapid postoperative increase in weight may overstretch the structures of the wall by increasing the volume of the abdominal contents.

Postoperative hernia may be of any size. The defect in the wall through which the contents of the hernial sac pass varies in area from a tiny opening to the involvement of an entire quadrant of the abdomen. Aggravated cases may require extensive resection of their visceral contents as pointed out by Haynes recently.

The fundus of the sac is generally separated from the overlying skin by a very thin layer of scar tissue (Fig. 388). It is here that the surgeon must employ infinite care to avoid opening the sac with coincident possible injury to the bowel. The contents, omentum and bowel, are practically always adherent to the sac. Adhesions between omentum and gut, and between adjoining loops of bowel, are generally found. They were present and extensive in all of the cases of this series. Pain due to the pull of such adhesions, together with kinking of the bowel, often brings these patients to the surgeon. Two of our series had gastro-intestinal symptoms referable to this.

Preparation of the patient for surgical treatment is important. In a large hernia a gradual readjustment of the intra-abdominal pressure by reducing the hernia and maintaining reduction with adhesive or a binder may prevent the development of serious postoperative embarrassment of the diaphragm, due to the sudden increase in abdominal contents. To the same end a strict obesity diet continued for several weeks before operation is of value. Sand-bags placed on the abdominal wall will accomplish the same result.

As in the simple laparotomy closure we feel that the main support in the operation of ventral hernioplasty is gained through imbrication of the fascia. The size and shape of the defect are carefully studied before operation and the type of fascia-plastic to be done is decided upon. That direction of closure is chosen which promises the least tension on sutures. The Mayo type of operation is the choice where the defect is circular or has a longer horizontal axis, but with a narrow defect having its long axis vertically, imbrication from side to side may appear more logical. In 8 of the 10 cases the latter was indicated, the Mayo type being used in the other 2. Preparation of the skin with

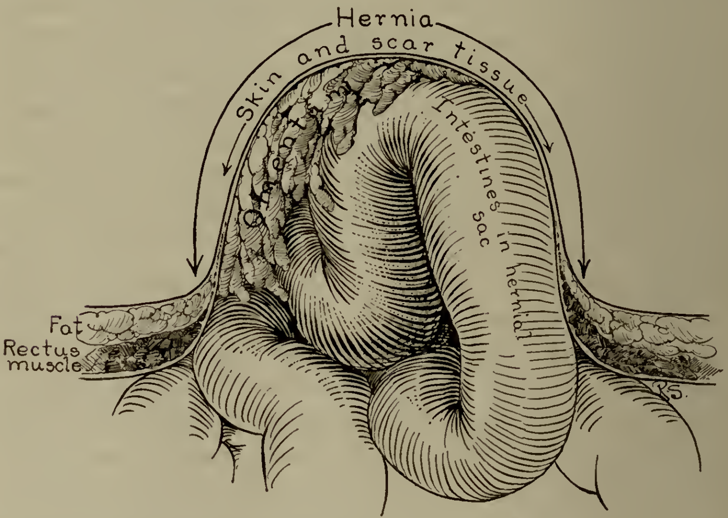

Fig. 388.—Emphasizing extreme thinning out of wall over fundus of hernia.

utmost asepsis is important because of disaster resulting with infection.

Often the old scar is excised completely by an elliptic skin incision, or in very stout people a transverse crescent-shaped

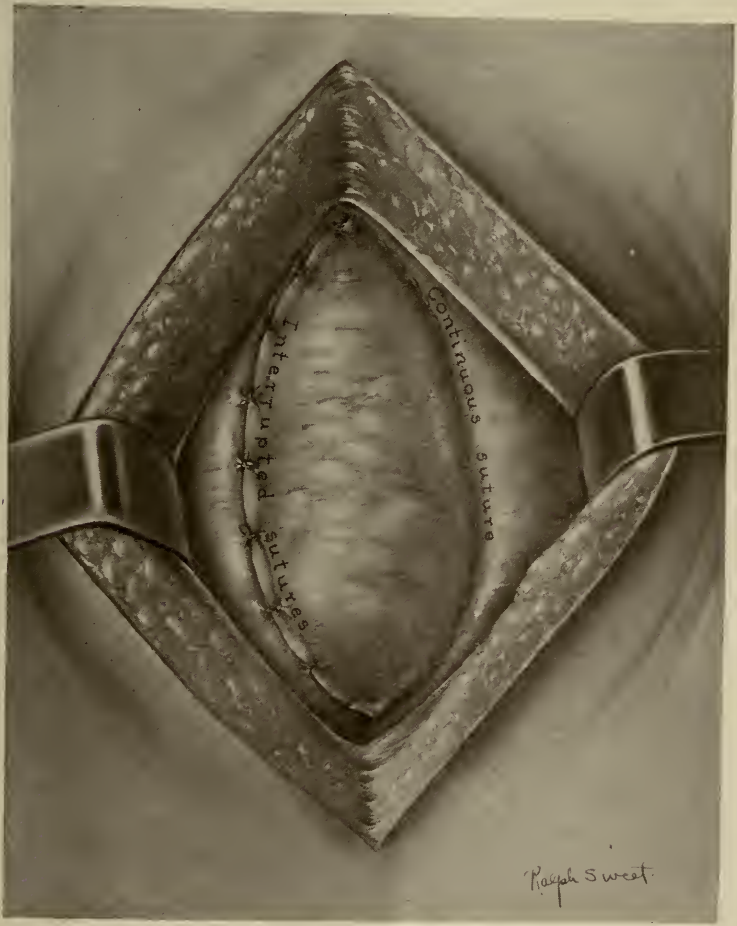

Fig. 389.—Imbrication of redundant peritoneum and transversalis fascia (or posterior sheath of the rectus).

incision, with excision of subcutaneous fat may be used. In 6 of our cases the scar was excised; in the other 4 the transverse incision was employed. Incision through the skin and subcutaneous fat is begun in a fairly normal region and developed down to the fascial layer. Working at this level the sac is approached cautiously from all angles. Dissection is carried up on to the sides of the sac as far as the fascia extends. The fascial layer is then dissected free from underlying structures. Rarely a muscular layer may also be dissected out. The sac is then opened with great care along the base of one side. Adherent omentum is excised; adherent gut freed and replaced in the

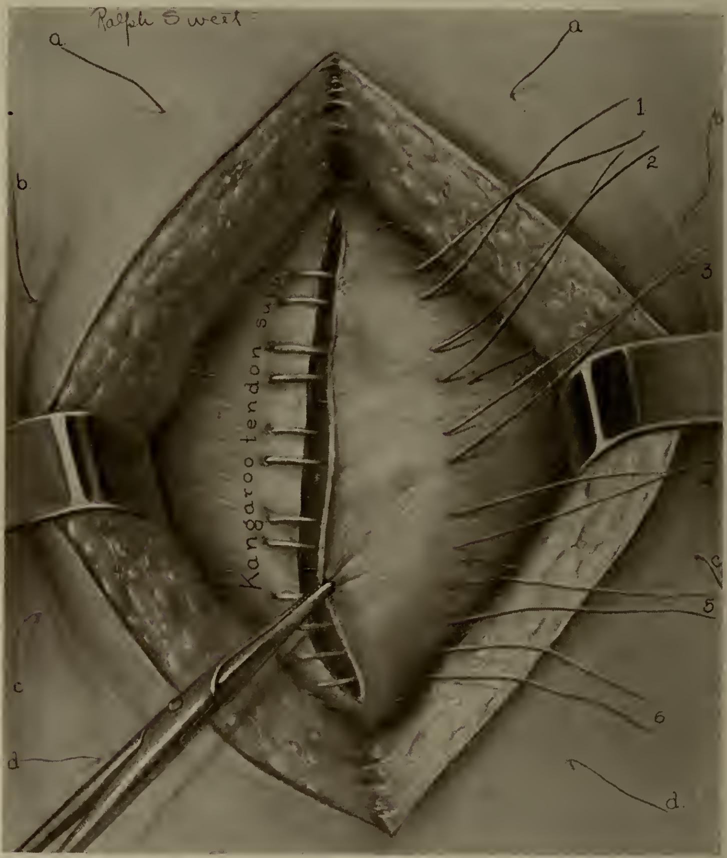

Fig. 390.—Kangaroo tendon mattress-sutures in the fascial layer: *a*, *b*, *c*, *d*, Dermal retention sutures placed.

abdominal cavity. The redundant peritoneum, scar tissue, and transversalis fascia, often a fairly strong layer, are used as a broad imbricating flap over the site of the defect (Fig. 389). If the muscle layer is available it is sutured together. Interrupted mattress-sutures of kangaroo tendon are laid in the fascia and then tied, with resultant overlapping (Fig. 390). As broad an imbrication as possible without severe tension is obtained. The free edge is held down with interrupted sutures of chromic gut (Fig. 391). Retention sutures of heavy dermal or silkworm-gut

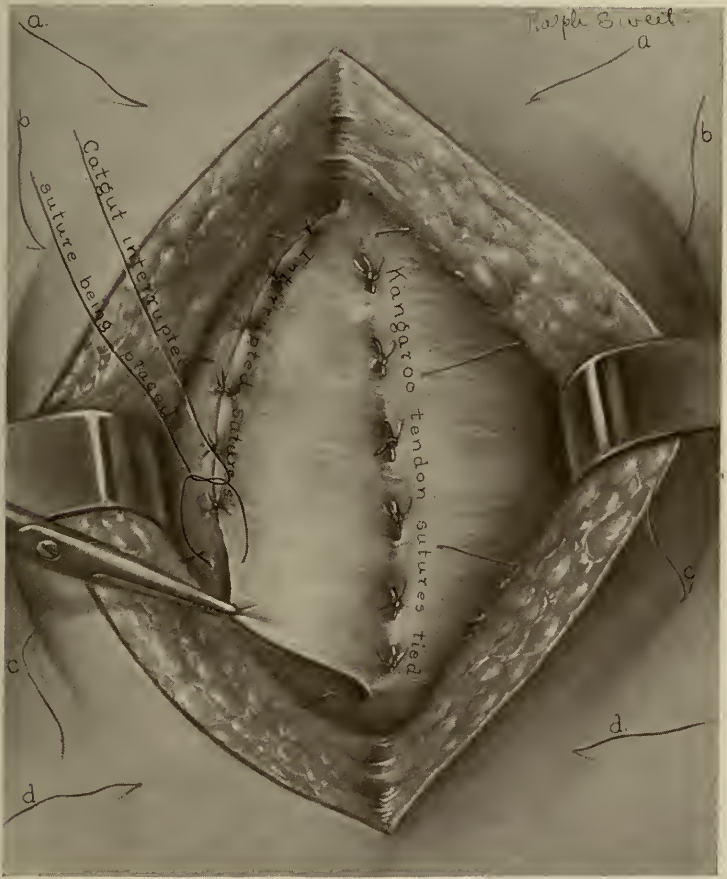

Fig. 391.—Mattress-sutures tied and imbrication completed.

are passed through the skin, subcutaneous fat, and the two flaps of fascia to reinforce the closure. Subcutaneous tissues are approximated with fine catgut and the skin closed with silk.

Where subcutaneous fat is excessive it should be protected throughout the operation with warm salt packs in order to prevent drying out and resultant fat necrosis.

If dissection is extensive a small rubber-dam drain for the first twenty-four or forty-eight hours is of value to carry off necrotic fat and other wound secretions.

If the defect is too large to permit closure a free fascial transplant may be employed. For this purpose fascia lata is ideal. In the absence of infection such a transplant practically always lives. A flap of fascia lata was used in one case of this series.

Postoperative care is important. The Fowler or semi-Fowler position should be maintained to relieve, as much as possible, the tension on the abdominal wall. Uncomplicated cases are allowed up on the fourteenth day.

In this series all of the hernias were in the lower abdomen. Five of them developed in midline scars of pelvic operations; 4 were low right rectus or lower right quadrant scars of operations for ruptured appendix. The remaining case developed a hernia in a right lower quadrant wound which had drained a badly neglected right pelvic peritonitis. The appendectomy cases had all drained from three to six weeks postoperatively. Four midline wounds had healed by first intention and one following a period of drainage.

Seven of the patients were females. These were all heavy patients. Four of them were over fifty years of age, the oldest being seventy-two. The three male patients were much younger, the oldest being twenty-five and the youngest eleven.

The hernia was noticed immediately after leaving the hospital in the case of 5 of the patients; 2 noted it in three months; 1 in fifteen months; and 1 four years later. The interval was not reported in one history.

In the series an interval of from six to fifteen months has elapsed since repair of the hernia. Eight of the patients have either been seen recently or have answered a "follow-up" questionnaire. All of these consider themselves cured. A personal examination of 6 of them revealed no weakness at the site of former hernia. Two cases still wear abdominal support. All are performing their regular work without hindrance.

In closing, we wish to outline the following points:

1. In all laparotomy closures imbrication of fascial layers is the most important technical step in avoidance of postoperative hernia.
2. In repair of postoperative hernia the hernial sac must be approached with great caution to avoid injury to contained viscera. The incision should be developed through a fairly normal part of the wall first and the layers identified before proceeding toward the abnormal scarred tissues of the area of herniation.
3. The fascia-plastic operation with broad imbrication of the important fascial planes by means of mattress-sutures of kangaroo tendon gives excellent results.
4. This imbrication should be developed in that direction which will result in the least amount of tension on the line of closure.
5. The pre- and postoperative care, as outlined, have an unusually important bearing on the results.

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